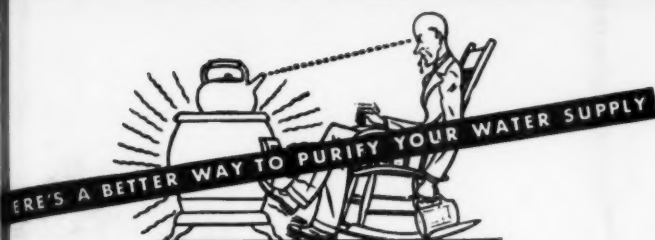


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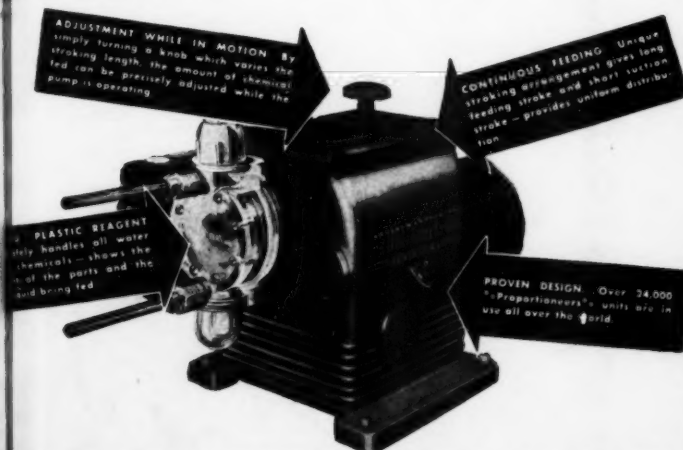
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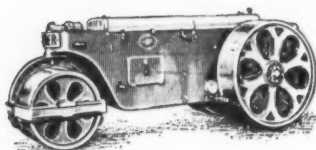
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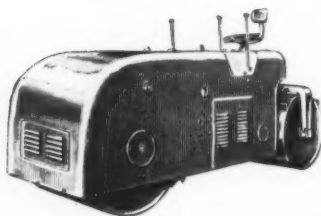
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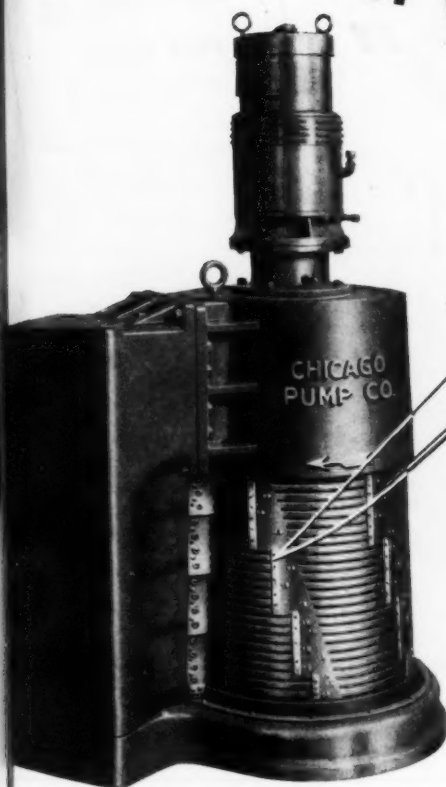
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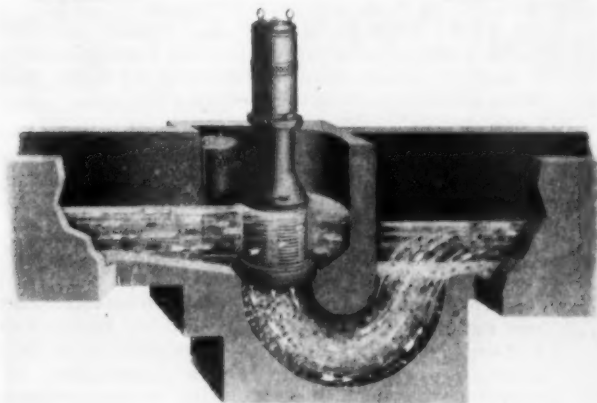
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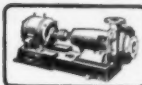


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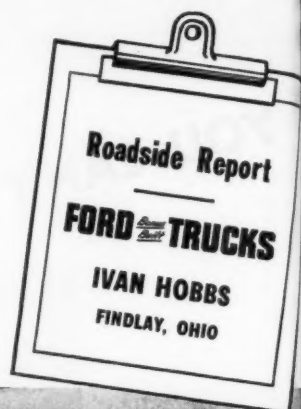
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PUBLIC WORKS

Founded in 1896

The engineering authority in the
city-county-state field

Edited by

W. A. HARDENBERGH and A. PRESCOTT FOLWELL

JANUARY, 1949

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How Much Does SAFETY Cost?

The Horton elevated tank shown above was recently erected to improve water pressure for fire protection and general service at the Alton State Hospital, Alton, Illinois.

The value of reliable fire protection is beyond price in an installation of this kind, yet it is obtained here as only one benefit of an over-all plan for better water service—elevated storage will provide steady water pressure for all the hospital's activities.

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The Editor's Page

The Cost of Public Service

Newspaper headlines almost every day come up with such statements as: "Government Costs Too Much"; "Over 3 Million on Government Payrolls"; "Taxes Are Triple What They Were 50 Years Ago." These statements are approximately true, but so what!

When we recall the taxes of 50 years ago we should recall also what we got for them. Most of our city streets and all of our roads were dirt or, at best, macadam. Sewers were few and inadequate and most of them emptied into a nearby watercourse. There was no sewage treatment. The water supplied was not clarified, softened, deodorized or, most important of all, sterilized. Garbage, if collected at all, was picked up by hog raisers using leaky and odorous wagons. Labor was paid a dollar a day and school teachers not much more.

City and other governmental officers who have these high tax complaints thrown at them might well reply with reminders of the above facts, and apply these particularly to local conditions. They might tell what proportion of the tax goes to each of these services and how much could be saved if taxpayers wished to go without.

In a New York suburb recently, where garbage was collected from back doors, a reply post card was sent to each property owner stating how much extra it cost to provide back-door collection as compared to curb collection and asking if he wished to "roll his own" garbage to the curb. It is hardly necessary to state that the vote was nearly 100% in favor of having the city continue "rolling."

Maybe this idea could be expanded and our citizens taught that it is the municipal services they demand that is so largely responsible for today's higher taxes.

"Activities Limited—Personnel Shortage"

A report that has recently reached us says: "Six men from our technical staff were engaged in military service. Only one of these men was on the payroll at the end of this fiscal year." The discussion of personnel problems is headed by the caption to this item, and it goes on to say that the critical shortage of engineering personnel has made it necessary to restrict activities.

There are two basic reasons for this. One is the extremely short-sighted policy regarding engineers that our war manpower managers adopted during the years of the war. Engineer production was practically eliminated. The second is the fact that our states, cities and counties have not provided adequate salaries for engineers. They have raised laborers; even school teachers have been remembered; but engineer salaries remain altogether too low. Engineers go to industry or to other fields of work.

The Civil Defense program recently announced will require engineering services. It thus constitutes one more drain that, in an emergency, must be met by our

present restricted supply of engineering personnel. It all adds up to the fact that engineers are, and must be considered, essential; and that better utilization of them in any future emergency is absolutely necessary.

Too Much Free Publicity

Most of our folks are uneasy, and especially those who went through the recent war. They read the rantings and ravings of certain of our former associates in that war, and they are pretty much fed up with the whole thing. They long for the days of peace of mind, moderate tax cuts and reasonable prices.

The UN provides for these ranters and ravers a sounding board for propaganda such as never before has been available. Our newspapers and our radio commentators repeat, ad infinitum and ad nauseam, all of this propaganda, over and over again, with big black headlines in the former and "inside" stories by the latter.

If the newspapers would decline to print all of this material and the radio commentators would also stop acting as sounding boards for it, we think that the situation would clarify itself considerably. We believe that a lot of the raving and ranting would stop just as soon as the authors of it found that their life's dream of oceans of free publicity to the biggest audience the world has ever known had ended.

Well, anyway, you won't find any of it in this magazine.

Pay Adjustments for Technical and Other Personnel

Adjustment plans to take care of the present high cost of living have been reported by a number of cities, but few states and counties. Admittedly, such plans are difficult to formulate on a fair basis, and they add to budgetary problems, but they are a necessity if our cities, counties and states are going to retain their skilled and efficient technical personnel.

In most cases, it appears that adjustments are based on the Bureau of Labor Statistics consumers' price index, and are limited to the first \$1200 to \$1600 of salary, though in some cases a decreasing rate of adjustment is applied to higher salaries. The latter is necessary, because a flat rise of pay otherwise results which would be satisfactory for the employee in the lower pay brackets, but totally inadequate in the case of high-grade technical personnel, such as engineers.

Whatever plan is adopted, the cost-of-living adjustment should consider the following: It should not be a bonus, but a part of the overall salary; it should recognize the necessity of making public employment attractive to the higher placed engineers and technical men; adjustments should be semi-annual, or more frequent; the procedure should be automatic, without necessity of action on the part of the employees; and it should take account of the standard of living as well as the cost of living.



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Letters

CONSTRUCTION COSTS—TOO HIGH?

Quite often, after a heated discussion with my wife, a particularly sparkling bit of repartee occurs to me hours later, which if I had thought of it in time would have clinched the argument and left me master of the situation. I have never tried writing my wife a letter under these conditions although perhaps this would be an effective way of having the last word.

In the first session of the Public Works Congress at Boston on October 18 I listened to "A Panel Discussion" on the subject, "Construction Costs—Too High?" which was thought-provoking in some respects and just plain provoking in others. Because of the lack of opportunity (and also because it takes me considerable time to think up a snappy answer) I was unable to express myself at the Congress. Because I think the matter is important I write this letter so that the principles set forth therein may also become a part of the record.

The discussion was ably presented by five speakers under the following respective headings:

- (a) The Viewpoint of Labor
- (b) As the Contractor Sees It
- (c) From the Materials Standpoint
- (d) A Consulting Engineer's Analysis
- (e) What the Consumer Thinks

Each of the speakers occupied a chair at the table and the discussion was presented in an interesting manner, much as a one-act play. Each of the speakers stayed well in character in the sentiment expressed. Each quickly passed the "dying cat" onto the others. If any moral were to be drawn from the skit it was to the effect that construction costs are not any higher than any other costs and, if construction costs are too high, there is nothing which any person or any particular group of persons can do about it.

It seems to me that there was a vacant chair and a missing character in the play. In order to round out the cast a sixth member should have been included. Perhaps his subject would have been, "An Old-Fashioned American Speaks." This suggestion is in no sense derogatory of the other speakers. I am sure that any of the other members of the panel could have taken the part in good character and have spoken the lines in spirit and in truth. If the old-fashioned American had spoken I think that his lines would have been somewhat as follows:

"Construction costs are too high if the purchaser does not receive value for the money he pays. We modern Americans are inclined to forget that the dollar in itself has no value. I suppose that fundamentally the only things actu-

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ly having value are the immortal soul of a man and the products of his hands and brain. My grandmother taught me, among other truths that 'Thou shalt earn thy bread by the sweat of thy brow' and 'Do unto others as you would that they should do unto you.' These laws are as true now as they were when they were first spoken and if they are being broken in construction work then the purchaser is not receiving true value for what he pays and construction costs are too high thereby.

"I believe that the great majority of people in America today would be happy in not doing one single lick of work if they could be assured of the comforts (and a few of the luxuries) of life. This statement applies not only to those who produce with their hands, but also those who produce with their brains. Everybody seems to take it for granted that he should receive more and more for doing less and less. This theory sounds nice but it happens to break the first law mentioned above. America did not reach her present status following such a principle. The ancient Greeks, however, almost perfected such a plan but about the time they reached perfection they were conquered by a group of horny-handed mountaineers who had not forgotten how to work. Until everybody on the construction project gives a full day's work for his pay, to that extent construction costs are and will be 'too high.'

"Because we have been and are in a seller's market' and because men are greedy, prices and profits are set for all the traffic will bear. This spirit breaks the second law stated above. Whenever price includes more than a fair profit when the purchaser is not receiving value for what he pays and construction costs are too high thereby and in that amount,

"As Americans we should not be guilty of intellectual dishonesty (kidding ourselves). Let us admit that construction costs are too high for these reasons and let us resolve to recognize these old American principles as stated in these two laws and to conduct ourselves accordingly."

It seems to me that certainly in historic Boston, "the cradle of liberty," the old-fashioned American should have had a chair in the panel discussion.

C. K. MATHEWS,
Burns & McDonnell
Engineering Company.

THAWING FROZEN WATER PIPES

I read with interest F. J. Purdy's article entitled "A Pipe-Thawer With Year-Around Usefulness" in the November issue of PUBLIC WORKS. I would like to add my comments, along with a word of caution.

In Bemidji, Minnesota, the "ice-ber" of the nation, the electric method of thawing frozen water mains and services has been used for some time with great success. However, with the increased use of copper service lines

NO JOB TOO SMALL NO JOB TOO LARGE

for

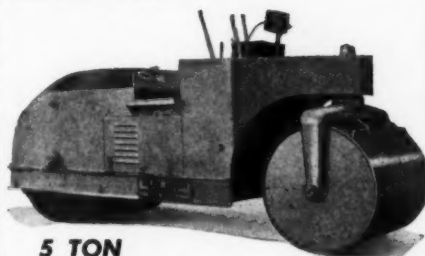
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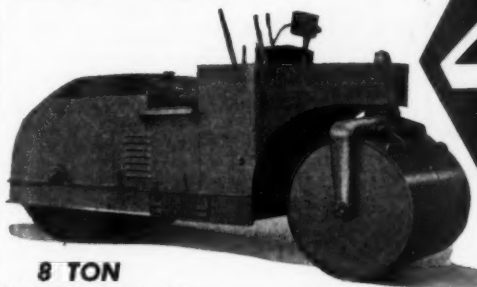
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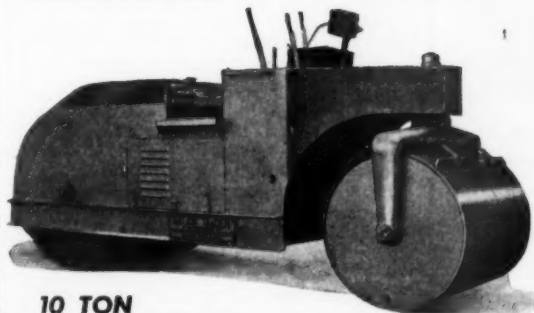
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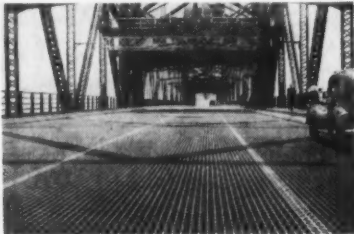
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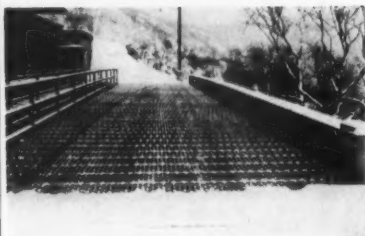
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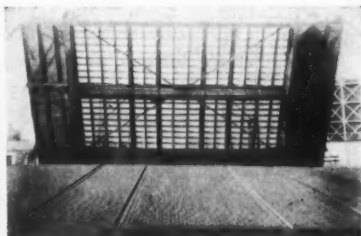
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Ft. Park Ave., Emeryville 8, Cal.

and mechanical joint, cast iron mains, caution must be exercised. About two years ago we purchased a supply of mechanical joint pipe, complete with rubber gaskets. It was not until we attempted to thaw a frozen copper service line did we realize that the mechanical joint pipe with plain rubber gasket will not conduct an electric current across the joint. As most electric wiring in residences is grounded to the water supply piping, a serious fire could result by use of the electric method of thawing.

After burning the insulation off of a furnace wiring system in a residence across the street from the one which we were attempting to thaw, we realized what was taking place. We immediately bonded the joints on mains then being installed, and replaced the non-conductor rubber gaskets with *lead-tipped* rubber gaskets which bond the joints for future installations. Since then our electric thawing machine has worked satisfactorily.

I have found many engineers and water superintendents in this State who were as unaware of this condition as we were, so I believe a word of caution is in order. I might add that some of the concerns who sell this pipe were not aware of the condition either, and should be tipped off.

M. J. KERANEN,
City Engineer,
Bemidji, Minn.

FIELD TRAINING

We conduct supervised field training for engineers during which time they observe and participate in the operations of numerous water and sewage treatment plants in this area. We have about fifteen for each three months course. These Engineers come from all over the world. Most of them are from the United States and we have had men from India, China, South America, Greece, Italy, Poland and Norway and in the future will continue to have trainees from many places. These men usually assume positions of responsibility in state and local health departments in this country and usually fill top Governmental positions in the foreign countries.

For our training purposes it would be very desirable if we had on hand at this Training Station a copy of your Handbook of Trickling Filter Design for our files, and, too, our trainees would have reference to the latest and most modern practices used in this country. If there is a charge for this Handbook please enclose a statement with the publication.

In case these trainees decide that your Handbook is so worthwhile that they would like to have it for their personal files, we would like to know if we can obtain additional copies for distribution.

C. D. SPANGLER,
Sanitary Engineer, USPHS,
Columbus Field Training Station,
Muscogee County Health Dept.,
Columbus, Georgia

A copy of the Trickling Filter Handbook has been sent; also other material that should be helpful. Additional copies of the Handbook are available. The Editors.



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VALVES:

A. W. W. A. type iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position.

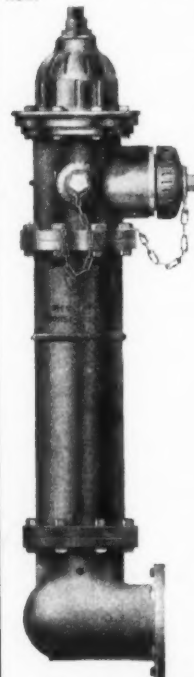


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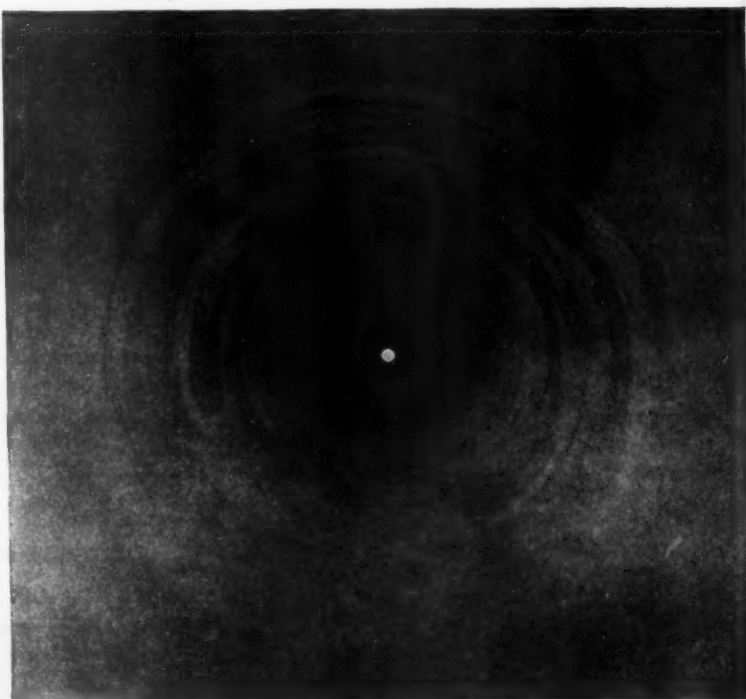
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When you need special information—consult the READERS' SERVICE DEPT. on pages 65-68



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Use snowplow or snow loader bucket for snow removal from narrow roads, streets, parks, schools, parking lots, airports, institutions, alleys, similar places.



FOR Dirt

Use material handling bucket for all kinds of digging and loading, building sanitary fills, and for working from stockpiles . . . use bulldozer for leveling, backfilling, any excavating.

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*HD-5 weighs 11,250 lbs. . . . provides 40.26 drawbar hp., 50.25 on belt.

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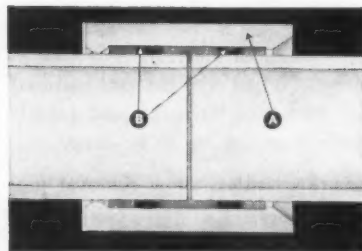
Engineering Facts about Johns-Manville TRANSITE PRESSURE PIPE *The Inyokern Earthquake*

WATER LINES are seldom required to withstand a test as severe as that to which a Transite* asbestos-cement Pipe installation was subjected at Inyokern, California, about two years ago. The Transite installation at Inyokern consists of over 300,000 feet of pipe and comprises the major portion of the water supply system for the vast Naval Ordnance Test Station located there.

During the early part of 1946, an earthquake of maximum intensity occurred in the Inyokern area. Shocks of great severity were felt throughout the immediate locality in which the Transite line was laid. Naturally, concern was felt at the Naval establishment for the safety of its water supply.

After the quake had subsided, crews were dispatched to repair whatever damage the lines might have suffered. A thorough search failed to reveal a single break or any evidence of leakage at any one of the 25,000 joints in the system. Subsequent careful check of pressures and measurement of water levels confirmed that the lines had remained intact.

The reason this Transite installation



This cutaway sketch shows construction of the Simplex Coupling used with Transite Pressure Pipe. It consists of Transite sleeve "A" and two rubber rings "B" which are tightly compressed between sleeve and pipe as the coupling is assembled.



This aerial view shows a portion of the Naval Ordnance Test Station at Inyokern, California.

was able to withstand this severe test is found in the inherent strength of the pipe and in the design of its Simplex Coupling, the standard coupling for Transite Pressure Pipe. Each of these couplings is a tight yet flexible link connecting one section of pipe to another and imparting to the line as a whole a degree of flexibility which enables it to "roll with the punch." Thus, shocks and vibrations are absorbed, stresses minimized to an unusual degree.

A factory-made joint which requires only assembly on the job, the Simplex Coupling derives its flexibility from its simple design. Consisting of a Transite sleeve and two rubber rings tightly compressed between pipe and sleeve, its

simplicity and ease of assembly are apparent from the accompanying illustration. Moreover, this coupling is readily checked for proper assembly as the line is laid—further assurance of tightness in each individual joint and in the line as a whole.

Probably your water lines will never be called upon to absorb punishment as severe as the Transite lines at Inyokern. But the same engineering advances which protected this Transite installation can be depended on to safeguard equally well against the stresses normally encountered in water line service.

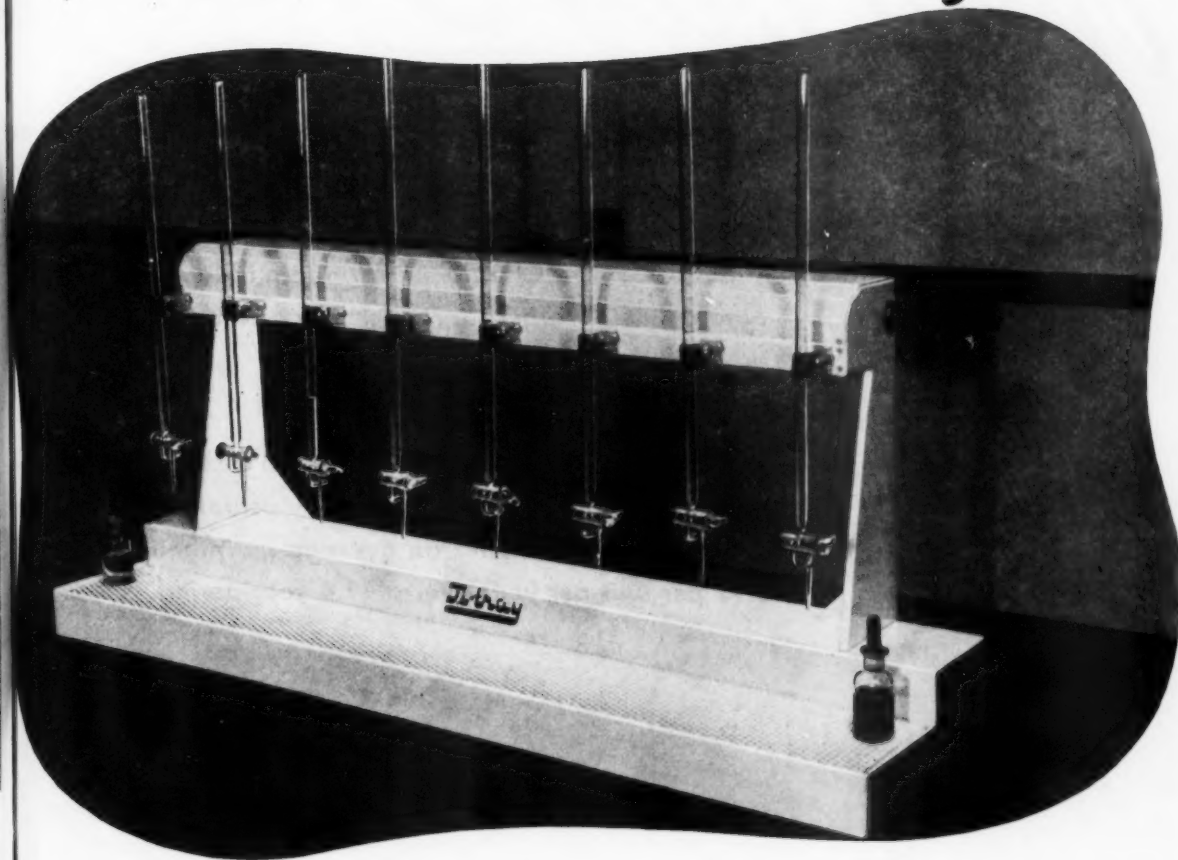
For further information about Transite Pressure Pipe, write Johns-Manville, Box 290, New York 16, N. Y.

*Transite is a registered Johns-Manville Trade Mark



When you need special information—consult the READERS' SERVICE DEPT. on pages 65-68

TITRATION ASSEMBLY "Ti-Tray"



An improved, compact, modern titrating assembly with built-in, shielded fluorescent illumination.

The support proper is white porcelain enamel, of sturdy construction, easy to clean and so designed that burette manipulation is within convenient reach and sight of the operator.

A removable stainless steel grid permits excess or overflowing liquids to pass into a trough at the bottom from which they drain at rear center to a receptacle or directly to the sink.

The burette holders are of stainless steel, rubber covered, securely fastened to the support and provide complete visibility to the graduated lines of the burette.

The shielded fluorescent illumination causes light to pass up and down the burettes and permits easy reading of the meniscus at any level.

Number of units	4	8
H-61135 Ti-Tray	\$65.00	\$95.00

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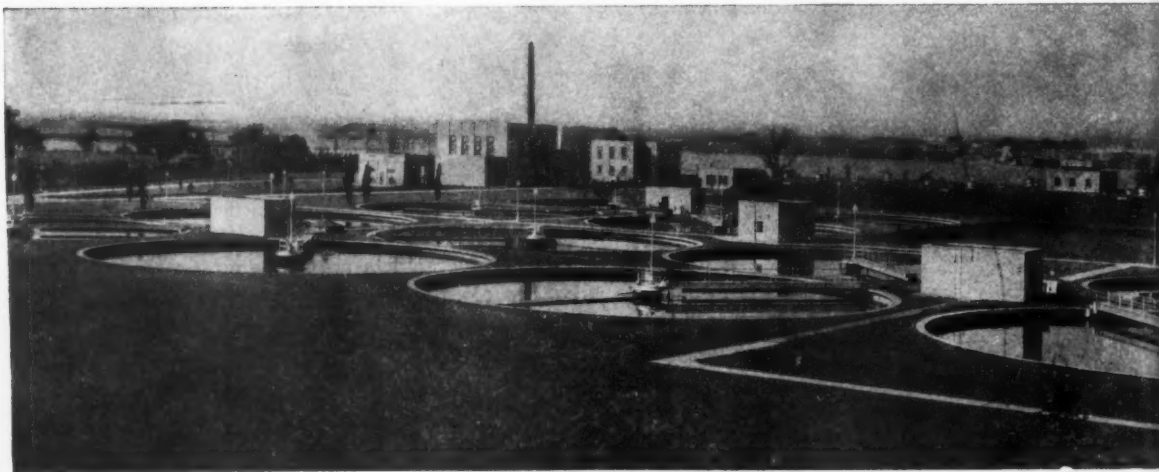
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No Two Cities Have Exactly The Same Trash and Rubbish Collection Problem...



The amazingly simple stages of pick-up, hauling and dumping the detachable containers are shown in the three photos above. In the top photo, driver has backed the truck hoisting unit up to the 8 cu. yd. apartment type container, attached two chains and returned to the hydraulic controls in the truck cab. In center photo, container has been hydraulically lifted into carrying position ready for hauling to disposal area for automatic dumping as shown in the bottom photo.

DEMPSTER DUMPSTER

TRADE MARK REG.

It's true! No two cities have the same problems of Trash and Rubbish Collection. In fact, no two parts of any one city have the same problems. In downtown areas, high concentrations of bulk rubbish must be collected almost daily; in housing centers some collections are made twice weekly and in residential districts one collection a week is sufficient. That's why in every city, a flexible system is needed. The Dempster-Dumpster System of rubbish collection meets every requirement.

With the Dempster-Dumpster System, your city can "tailor" rubbish collection to meet the output of any given section, regardless of the volume. Here's how it works. Enclosed rubbish containers, such as the one shown below are placed at collection points in business districts, apartment and housing areas, at schools and at factories. Once the rubbish is placed in these containers, no wind or animal can scatter it, no rats or flies can contaminate it. As these containers are filled, a Dempster-Dumpster truck hoisting unit, operating on scheduled rounds, picks up each container hydraulically, hauls it to and dumps it at the disposal area, then returns the empty container to its original position. One truck and one man, the driver, handle the entire operation at a tremendous saving in time, money and equipment. Why not write today for complete information.



DEMPSTER BROTHERS, Inc., 9118 Dempster Bldg., Knoxville 17, Tenn.

When you need special information—consult the READERS' SERVICE DEPT. on pages 65-68

Good Practice in

BACKFILLING SEWER TRENCHES

CONSIDERATIONS important in backfilling trenches for sewers have been prepared by the Clay Sewer Pipe Assn., and these are summarized in the following paragraphs as a guide to good practice.

Generally speaking, earth removed from trenches during excavation is satisfactory for backfilling, but boulders, debris, frozen or other improper material should be excluded. All trenches should be backfilled as soon as inspection of pipe work is complete. This avoids unnecessary risk of damage to the line and also reduces risk of accidents involving the public.

It is not good practice to walk or work on top of the completed sewer, except as may be necessary in tamping or backfilling, until the trench has been backfilled to a height at least two feet above top of the pipe.

Placing Backfill

Backfill up to a level two feet over the pipe top should be placed manually in layers not exceeding six inches in thickness. Each layer should be thoroughly consolidated by manual or pneumatic tamping before the next is placed. The remaining backfill may be placed either manually or mechanically. In no case, however, should backfill contain stones larger than six inches in their greatest dimension, nor should any frozen backfill be placed. If backfill is placed in upper portions of trenches with the use of bulldozers, extreme care should be taken to see that it is evenly distributed over the width of

the trench and along the length of the trench section in which backfill is applied. The depth of backfill should be brought up evenly with no appreciable unbalance of weight in any short length.

All material being replaced in trenches should be examined continuously to see that it is of fairly uniform gradation and placed so that the distribution of voids in the backfill is uniform and so that void spaces are minimized.

"Puddling"

Used here the word "puddle" means to flood the trench with water as backfill is placed. Some contractors and engineers hold that this is good practice, based on the idea that the water content of the earth mass, adding weight, induces rapid and more thorough consolidation. It is believed that such analysis can be extended, arriving at a different conclusion. Consider two extremes of backfill: (1) with no moisture content, (2) backfill that is "puddled." In the first instance, earth particles are not lubricated and set up resistance against finding positions that result in maximum density of the mass. In the case of saturated backfill, particles are surrounded by a film of liquid which tends to keep them separated and again maximum density is not attained. Between these limits there is an ideal moisture content at which maximum density of the backfill can occur. With maximum density at the time of placing, backfill will reach ultimate consolidation

within the shortest time period. "Puddling" therefore, is as objectionable as bone-dry backfill.

Tamping backfill material under the haunches of the pipe is essential to prevent lateral movement during and after placing the remainder of the backfill. Pipe strength is reduced if such tamping is omitted, but tamping of backfill under the pipe haunches does not of itself give greater load-bearing strength to the pipe.

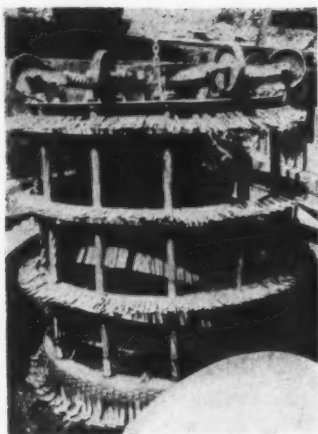
Traffic Limitations

Failures of pipe lines may occur as a result of heavy wheel loads being permitted to travel over freshly backfilled trenches. Failures do not occur with similar wheel loads if enough time has been allowed to assure sufficient backfill consolidation.

Most engineering departments require that contractors maintain backfill in freshly filled trenches to the same level as the adjacent surface. When a trench is backfilled, consolidation is a gradual process and with the passage of time the top of the backfill sinks as consolidation is effected. As a result, contractors are required to furnish additional material to maintain the top of the backfill at the same level as the adjacent earth. It is normal for contractors to barricade trenches throughout the period that such additions may be necessary.

Under changes in construction practices now taking place, neither cities nor private builders can keep trench surfaces out of service as long as formerly. However, an even longer time may be required to obtain the more thorough consolidation required for modern high wheel loadings. It is recommended that all backfilled trenches subject to street traffic should be barricaded for at least 48 hours.

Although time required to construct sewer and drain lines has been considerably reduced through wider use of machinery, speed at which backfill can be applied properly has changed little. In view of today's heavier wheel-loading conditions, it is more than ever necessary that this phase of construction be rigidly supervised, and that specifications for trench backfilling should be tightened.



Cleaning device for 62-inch pipe.

THE Howard Bend plant of the St. Louis Water Division, constructed on the Missouri River during 1924 to 1930, was designed for an ultimate capacity of 160 mgd. Provision was made for three 60-inch steel conduits to convey the finished water 9 miles to Stacy Park reservoir, and thence an additional 7 miles to the City. The initial capacity of the plant, as built, was 50 mgd, and only one conduit was laid at that time. In 1932, five additional basins were constructed, bringing the purification capacity up to 80 mgd. During 1934 to 1938, a second 60-inch conduit was laid in two sections, No. 2 and No. 2A, increasing the conduit capacity to 110 mgd, and making it possible to take either conduit out of service for repairs without shutting down the Howard Bend plant.

In the construction of the first conduit approximately 5 miles of hammerwelded pipe was used in the section between the plant and Stacy Park reservoir, the remainder being riveted pipe. The hammerwelded pipe is 60" inside diameter and is in 30' lengths, connected with riveted girth seams. The riveted pipe is made up of sections 7' 6" long between pitch lines and of such diameters that every other section telescopes into the sections next to it. On account of the great number of rivet heads inside of this pipe, the minimum inside diameter was made 62" on the assumption that the hydraulic characteristics would be about the same as of a 60" welded pipe. This conduit was laid in 1925 and 1926, and stood full of water practically from the date of laying until 1929 when it was put into service concurrently with the starting of Howard Bend plant.

In 1935, leaks on the 62" conduit, due to pitting from the outside, occurred at three locations between the

reservoir and the City limits where the conduit crosses under roads in which other pipes are located. The leaks were uncovered, and by means of electric welding, patches were installed over the holes and the pits that did not penetrate the wall of the pipe were filled with metal from the electrode.

Causes of Pitting

At that time the pitting was thought to be due to electrolysis caused by stray currents from street-car lines. With the co-operation of the other utilities some electric bonds between the conduit and other underground structures were installed with beneficial results. However, the number of leaks repaired annually increased and some pitting occurred at points distant from street-car lines and other current-carrying structures. It was noticed that at most places where the pitting occurred, organic matter such as sticks and leaves had been deposited next to the pipe when the backfill was made, creating a condition favorable for the presence of

sulfate reducing bacteria which might be responsible for the pitting. Samples of the soil adjacent to the pitted areas were examined in our bacteriological laboratory and in nearly every case the presence of *Sporovibrio Desulfuricans* was confirmed. Most of the leakage occurred along a 3¼-mile section of conduit west of the St. Louis City limits.

The following amounts were spent annually during the fiscal years 1936 to 1947 for making repairs along this section of conduit on account of leakage.

Year Ending April,	Amount
1936	\$ 385.
37	277.
38	4,440.
39	412.
40	2,406.
41	1,818.
42	3,210.
43	6,042.
44	6,473.
45	5,095.
46	9,604.
47	9,039.



The pipe lining machine.

Lining 62" and 36" Pipe Returns 13% on Cost

JOHN B. DEAN

Division Engineer, Supply and Purifying Section,
Water Division, St. Louis, Mo.

At a cost of \$79,662, savings are estimated at \$10,370 a year in reduced maintenance and loss of water, increased capacity and other advantages. Value of "C" increased from 124 to 141.

PUBLI

Because repairing decided proxima main on siderab cept at the wa butt-we in leng with D 62" pi and di diately

A c ing in ft. and \$3.35 Corpor May 1 on the This f tional clean t mit ins

The s

cleani chines of the duit a steel were these ing i where to per in cle The was s west ing n mova of th the c Stacy radio manip voir; party and a

Because of the high annual cost of repairing this section of pipe it was decided to line it and also to line approximately a mile of 36" steel water main on Hampton Avenue where considerable leakage had occurred. Except at specials which are of cast iron, the water main is constructed of butt-welded steel pipe 7/16" thick in lengths of 30 and 32 feet, joined with Dresser couplings. The 36" and 62" pipe was coated by preheating and dipping into hot asphalt immediately after fabrication.

Cleaning the Pipe

A contract to install a 3/8" lining in the 62" conduit for \$4.20 per ft. and in the 36" water main for \$3.35 per ft. was let to Centriline Corporation of New York City on May 17, 1947, and work was started on the 62" conduit on June 5th. This firm let a subcontract to National Water Main Cleaning Co. to clean the conduit and main. To permit insertion and removal of the pipe

cruising over the route. By the use of these radios, messages relative to regulating and shutting off the flow were transmitted to the men at the reservoir. The rate of flow required to propel the 62" cleaner was approximately 35 mgd. Prior to turning the water on, all blow-off valves had been opened and as soon as the cleaning machine passed they were closed. A large amount of disintegrated coating and rust came out ahead of the cleaner through the blow-offs and at the water-course. The cleaner, which was damaged because of the pipe being out of round and dented, was repaired and sent through the pipe a second time.

The machine cleaning of the conduit east of the water-course was done in the same manner, except that water from conduit No. 2 was used to propel the cleaner. Cleaning had to be done in two sections because of a reduction in the size of pipe where a 48" valve occurred, and this made it necessary to cut out a 6' length of conduit on either side of the valve.

A mechanical cleaner was run through the 36" main three times between Elizabeth and Marquette Avenues. The water for propelling the cleaner was taken out of the distribution system and disposed of through street inlets. After cleaning by machine had been completed, all of the water was removed from the section to be lined and all remaining incrustation, disintegrated coating and rust were removed from the interior surface by the use of hand scrapers and wire brushes. All holes found in the wall of the pipe were closed with steel screw plugs or wooden plugs to prevent the flow of water back into the pipe from the soil. Any moisture remaining on the inside wall was wiped off with burlap just prior to lining the pipe.

Details of Lining

The mortar for lining consisted of 5 bags of Portland cement, one bag of natural cement, 6 cubic feet of Meramec River fine sand and approximately 24 gallons of water per batch. The sand was dried and screened through a No. 16 screen by use of a portable drying and screening unit and stored in cloth cement bags. The mortar was mixed in a mixer installed at the rear end of a large truck which had an enclosed body into which the cement and dried sand were unloaded from the service truck. The outfit was set over a manhole or opening cut in the top of the pipe, so that the mortar discharged from the mixer could be conveyed through a chute into small cars or buggies below for transport-



A view of the completed lining in a 62-inch pipe.

ing to the lining machine. In the 36" main and most of the 62" conduit, small cars, which were pushed by hand, were used. In the final part of the work on the conduit, electrically driven buggies were used for transporting mortar. The riveted seams interfered with the movement of the small cars and caused spilling of mortar due to the rebound from passing over the rivets' heads. This did not occur when the buggies were used.

The electrically driven lining machine deposits the mortar on the interior surface of the pipe by centrifugal force resulting from the rotation of a dispensing head at approximately 1,000 rpm. A feed screw forces mortar into the dispensing head which has slots and toothed vanes around the periphery from which the mortar is thrown as a fine spray onto the walls of the pipe. The thickness of lining, which in this case was 3/8-inch, is determined by the speed of travel of the lining machine through the pipe. After deposition on the interior of pipe, the mortar is finished by four rotating trowels. The machine backs away from the finished work, usually starting at a low point and progressing up grade to the point where the mortar is discharged into the pipe. As soon as possible after the lining is placed it is inspected and repaired; some water is admitted to the pipe; and all manholes and other openings are closed in order to keep the humidity as high as possible while the mortar is curing. The picture of the interior of the 62" pipe after lining, shows condensation on the surface of the lining, which is the ideal condition for curing the mortar.

The lining of the conduit and the water main was completed on August 11, 1947, 68 days after the date of

(Continued on page 26)



The small cars used for transporting mortar..

cleaning and mortar spinning machines, sections 6' long were cut out of the pipe at four places on the conduit and two places on the main; and steel couplings with rubber gaskets were used temporarily to reconnect these sections in place. Another opening in the conduit pipe was made where it passes under a water-course to permit the discharge of water used in cleaning the pipe.

The work of cleaning and lining was started on the part of the conduit west of this water-course. The cleaning machine was inserted in the removable section at the western limit of the contract and forced through the conduit by water admitted from Stacy Park reservoir. A walkie-talkie radio was left with the men who manipulated the gate at the reservoir; another was carried by the party following the cleaning machine and another was on a pick-up truck

FUNCTIONAL AIRPORT DESIGN

EDWARD PAYSON HALL

Airport Design and Planning Consultant

EXISTENCE of the airplane, as a transport vehicle, is justified primarily by the fact that it offers higher speed than any other transportation medium yet in use. Surface transportation offers lower cost and frequently offers greater comfort, but rarely can surface transportation move people and goods as fast as the airplane. It follows that the primary purpose of the airport, as a transportation facility, is to exploit the speed and load-carrying ability of the airplane to provide the fastest *city-to-city transportation* possible. High speed between *airports* is of no value to the community if the airport does not permit faster commercial *transportation* between *population centers* than existing surface transportation!

To maintain the position of the airplane as the fastest common carrier, continual technological development of the airport must keep pace with the development of the airplane; so far airport development has lagged far behind. New postwar transport airplanes operate at cruising speeds that are almost 60% higher than prewar transports, yet this increase in speed has resulted in an average increase in city-to-city speed of *less than 20%*! A further increase in cruising speed of 60% will result in an increase in speed of only 14% between cities! City-to-city speed will drop further and further behind airplane cruising speed unless technological airport development catches up with advancement in airplane design.

The airport is not merely a place for airplane take-offs and landings; it is an extremely important *functional* link in a world-wide transportation system. How well this global transportation system serves the community is dependent almost entirely on how well the functional design of the airport has been carried out and integrated with the factors peculiar to the particular community.

To understand functional airport design requirements, it is first necessary to analyze airline operating procedures as they relate to airport usage and also to analyze the trends

in airplane design that bear upon landing and take-off performance. Airline operating procedures and airplane design trends are now quite clearly defined and it is possible to project future functional requirements with considerable accuracy.

City-to-City Speed

Functional airport design provides the key to fast city-to-city air transportation. The average airline passenger makes a trip of approximately 500 miles and, since the average flight segment is about 250 miles, the average passenger uses three airports during his trip—one at his point of origin, one at an intermediate stop and one at his destination. Over *one third* of the average passenger's city-to-city travel time is spent *on the ground*! (See Figure 1a)

Greatest time consumers are the trips from city to airport and airport to city. Average airport to city distance of communities receiving scheduled air transportation is 8.7 miles. At an optimistic limousine speed of 30 mph, the two surface transportation segments account for a total of 35 minutes! For every mile that can be saved by locating the airport closer to the city, at last two minutes can be saved for each arriving and departing passenger!

Airplane Ground Time

One of the most useless and most aggravating delays to the passenger is the delay after the airplane has left the terminal ramp and before take-off. A survey at one of the larger typical airports shows that transport airplanes taxied an average distance of 3780 feet in 2.2 minutes to arrive at the end of the take-off runway. Large super-airports now being

planned and built will require double the average take-off distances found in the survey.

Reduction of take-off taxi time requires that the take-off runway start as near as practicable to the terminal building in order that the taxi distance may be short. Flying dirt, stones and debris in the air-blast from propellers at high power prevents the take-off runway from starting at the loading apron, but the point of take-off should and can be located within 1500 feet of the loading point. Take-off taxi time could thus be reduced to 0.9 minute, a saving of 1.3 minutes on each take-off.

Airplane operating rules give landing aircraft right-of-way over aircraft taking off. If the same runway is used for both take-off and landing, there will be certain periods when the runway is needed for both operations at the same time and the airplanes preparing to take-off will be delayed. In the survey mentioned previously, scheduled transport airplanes were delayed an average of 1.9 minutes per take-off! Only by *complete* segregation of landing and take-off operations can this type of delay be eliminated. Conventional dual parallel runways are only a partial solution since it will be necessary for either the arriving or departing airplane to taxi *across* the runway providing the opposite function.

The survey showed that scheduled transport airplanes taxied an average distance of 3090 feet in 1.7 minutes after the landing roll. It need hardly be pointed out that larger, more elaborate airports will involve even greater landing taxi distance and time.

To reduce landing taxi time, it is imperative that the landing runway

PRIMARY FUNCTIONAL AIRPORT DESIGN REQUIREMENTS

1. Adequate usable runway length now with provisions for future increase.
2. Airport site close to the center of population.
3. Good access from airport to city by a short route.
4. Start of take-off close to the loading apron.
5. Complete segregation of landing and take-off operations.
6. End of landing runway close to the loading apron.

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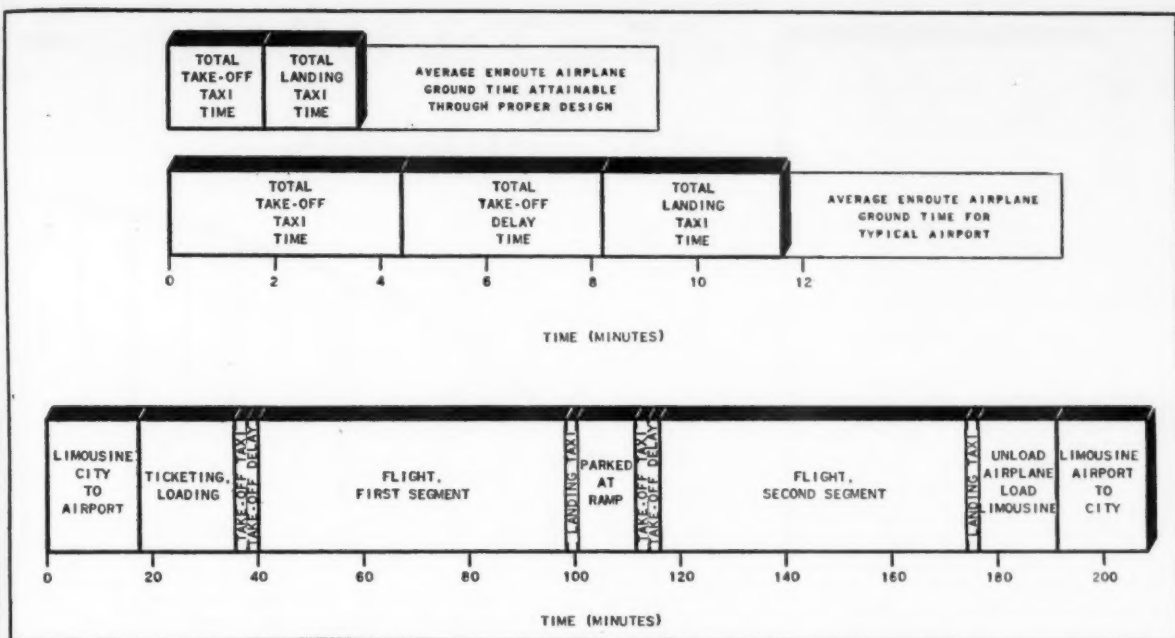


Fig. 1a, lower chart, shows the breakdown of city-to-city time for average passenger trip.

Fig. 1b, above, shows breakdown of average enroute airplane ground time.

terminate as near as possible to the loading apron. Emergency operation and possibility of a faulty approach requiring a go-around both prevent the landing runway from terminating directly at the apron. None-the-less, landing taxi distance should never be more than 1500 feet and would show a reduction of 0.8 minute on each landing over the time found to be necessary in the survey.

Since the average passenger makes a trip involving two landings and two take-offs, delays due to excessive taxiing during landing and take-off and due to runway congestion occur twice during each trip. Figure 1b shows the breakdown of airplane ground time of the average passenger together with the ground time attainable with proper consideration of the functional requirements of airport design. Note that 8 minutes can be saved for the average passenger on airplane ground time alone on every trip he takes!

Cruising Speed: 500 MPH

Had this article started with the statement that the 500 mph transport airplane was in operation today, there are few people who would have believed it; and yet the equivalent of the 500 mph transport airplane is here today with proper airport design! Figure 2 shows the equivalent increase in cruising speed required for the average flight segment of 250 miles to reduce city-to-city time by various increments. A reduction of

only 21.2 minutes is equivalent to increasing the cruising speed of the airplane from 300 to 500 mph! In other words, if one properly designed airport will permit a reduction of 21.2 minutes in city-to-city time over a typical, present-day airport, airplanes operating from the latter airport would require cruising speeds of 500 mph to provide the same city-to-city speed as an airplane cruising at 300 mph and operating from the properly designed airport! If the average city to airport distance could be reduced from 8.7 to 4.4 miles and the airport designed to fit the functional requirements of air transportation, the equivalent cruising speed of today's new transport airplanes would be increased to 500 mph!

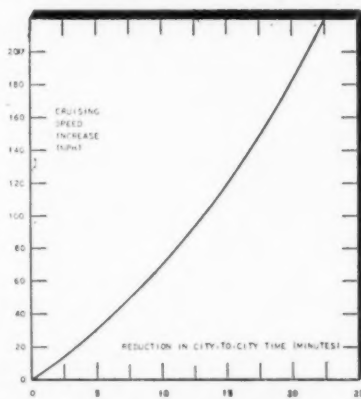


Fig. 2. Equivalent cruising speed to reduce city-to-city time.

Even fast city-to-city speed, in itself, is of no value to the community unless this speed is coupled with ability to transport payload from one city to another. To secure high payload capacity, no other single airport design consideration is so important as that of having adequate usable runway length.

Runway Length and Airplane Design Trends

Prior to 1946 the length of the runway required at full payload for transport airplanes was effectively limited by Federal regulations which established certain minimum performance requirements. But in 1946 one of these regulations, the 80 mph limitation on maximum stalling speed, was eliminated and the airplane designer was permitted to develop faster and more efficient airplanes by reducing wing area and increasing power. Abolishing the stalling speed requirement removed the effective limitation on runway length, and airplanes in the near future may require runways considerably longer than the sea-level length of 6000 feet considered adequate for domestic operation today.

Transport airplane take-off weight is higher than landing weight because of the fuel consumed enroute; the longer the flight, the higher the take-off weight. Since higher take-off weights require longer runways for take-off, it is apparent that those communities which expect to originate

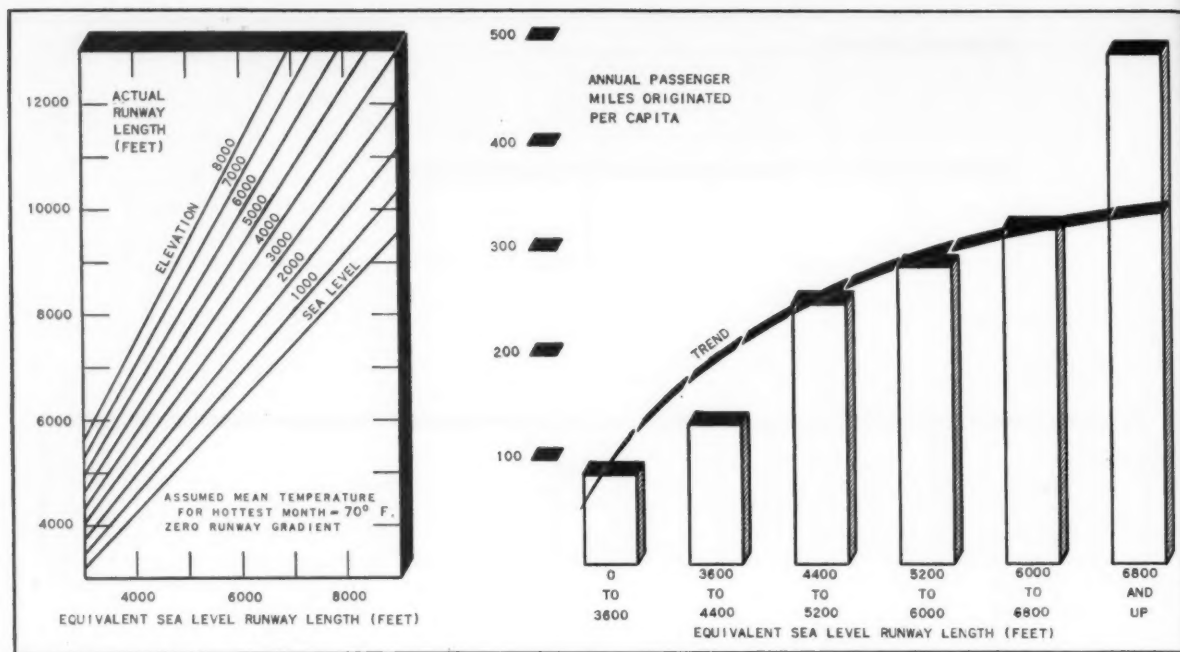


Fig. 3, left, shows actual runway length in terms of equivalent sea-level runway length. Fig. 4, right, shows how available runway length influences passenger miles originated.

long distance flights must provide runways that are much longer than runways required for flights of less than 500 miles.

Although war-born turbo-jet power plants can soon be expected to provide phenomenal speed for transport aircraft, this type of power plant does not have as much static thrust or "initial push" as a conventional propeller-driven airplane during take-off. This development, too, will tend toward longer future runways.

Reversible pitch propellers permit present-day transports to stop in very short distances *once the airplane is safely on the runway*. However, elimination of the stall speed limitation has increased the approach and "touch-down" speeds of new transports, making a slight pilot error a serious error on point of contact with the runway. Once again, the future landing runway must be longer or a cleared, sodded, level space must be available beyond the landing runway for emergency operation. (See "Airport Operational Safety," *Public Works Magazine*, April, 1948.)

Runway Length Dictated by Operating Requirements

Airplane design trends are definitely toward longer runways and communities not now planning for long runways, or without provisions for expansion to long runways, soon will find their airports to be obsolete and capable of handling only the relatively slow airplanes of today.

Runway elevation, mean temperature of the hottest month, and runway gradient all have very pronounced effects upon runway length required. Figure 3 shows the actual runway length in terms of equivalent sea level runway length for a representative mean temperature of the hottest month of 70° F. Note that a runway of 6000 feet at an elevation of 3000 feet is equivalent to a sea level runway of only 4500 feet. The length of the actual runway must be further increased by 20% for each 1% of effective runway gradient unless airplanes always take-off down grade and land up grade.

Airlines cannot afford to provide the best service to the community unless adequate usable runway length is available to permit operation at full payload. That the airlines are willing to provide better service at airports with long runways is clearly indicated by Figure 4 which shows the average number of passenger miles originated per capita per year for cities of more than 200,000 population in terms of the length of the longest runway available at each airport. Although influenced by many other factors, airports with long runways show a definite and pronounced tendency to generate a greater

amount of air travel. This is attributed to the fact that the airlines can afford to provide better service by more frequent flights at lower passenger fares.

Airline traffic fluctuates widely, even on long established routes. Some flights may require an "extra section" while other flights on the same route on another day may operate almost empty. Airlines attempt to operate at an *average* of 60% to 70% of maximum capacity in order to have reserve capacity to handle traffic peaks. When one airport on a route has insufficient runway length to permit operation at full payload, that airport becomes a "bottle-neck." It restricts the amount of payload that may be carried through that airport, not only restricting service to the community with the short runway, but having a contagious effect upon all other communities on the route during peak operations.

To illustrate the loss of payload, assume that one community at an elevation of 3000 feet in the middle of a four-segment, 2000-mile route has an airport with a longest runway of 4750 feet. A typical transport airplane must reduce its payload by 7000 pounds or 53% in order to land safely on the short runway available. If each segment on the route were operated at an average of 65% of the maximum capacity of the segment with only one round trip per day, the loss due to one inadequate airport

This is the first of a series of articles by Mr. Hall.—The Editors.

(Continued on page 26)

County Builds Concrete Stadium

F. W. DENNER

County Engineer, Enid, Okla.

BONDS in the amount of \$350,000 were recently voted by Garfield County for the construction of a new Fair Grounds. A 160-acre farm joining Enid on the north was purchased and 83,000 cubic yards of earth was moved to bring it to a satisfactory grade. A complete layout of buildings, which it will take some years to complete, was agreed upon and work started in the summer of 1947 on the most needed of these buildings. All utilities were designed and built on the basis of our over-all building program, although their capacity will not be utilized for a number of years. Locations were also provided for a baseball park, picnic parks, bridle paths, circus grounds and carnival grounds.

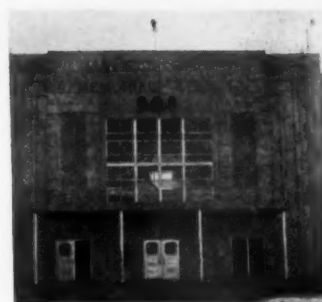
Two barns, each 62'x140', and one barn 150'x150', were completed this spring. These barns were all built of concrete, by the tilt-up method. The walls were cast in sections on the ground, tilted to their proper position on the foundation when seven days old, and were then tied together with pilasters which were cast in place. This type of construction is comparatively new in Oklahoma, but it proved to be very satisfactory.

A half-mile race track with a quarter-mile straight-a-way was built of local material and partly lighted for night racing. A midget auto track was also built and fully lighted.

Stadium Details

Perhaps the most important single feature of the grounds is the Stadium which has just been completed. It is 300' long, 100' wide and 40' high. It is built entirely of architectural concrete and is fully enclosed. The exterior walls were scored by lightly nailing a wood strip to the forms, which set the surface off into blocks 2' high by 8' long. As the face of the exterior was formed with 4' plywood and the surface was given a carborundum finish, the stadium looks as if it were built of large limestone blocks and is very pleasing in appearance.

The structure was built in four sections with a one-inch expansion joint between each section. In addition a vertical control joint or plane of weakness was built into the walls every twenty feet. These control joints were located at the centers of the windows. The walls are 6 inches thick, reinforced with $\frac{3}{8}$ " bars both



Main entrance of stadium.

ways, so they have ample strength to cantilever over one-half of the window span. The result has been that all cracks have been confined to these control joints and are visible only on close inspection. Very few of the walls have a foundation as they are supported on wall beams which were run monolithic with the columns. Dividing or protection walls between the upper floors were run with the columns and serve as inverted beams to carry the floor.

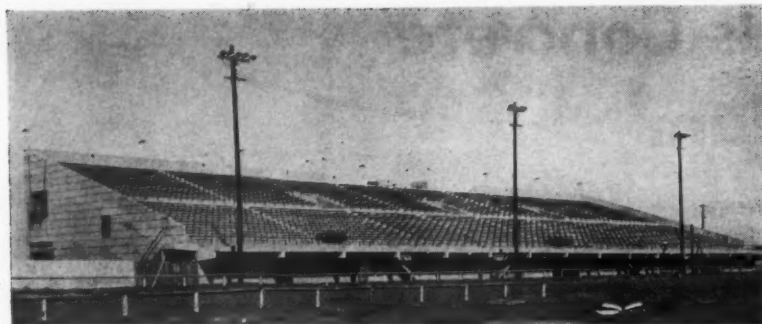
An Acre of Usable Floor Space

The building contains 40,000 square feet of usable floor space, with concrete floors on three levels. The several levels and the deck are reached by means of broad stairways. These stairways are perhaps a bit unorthodox, as the tread is 15 inches and the riser is $4\frac{1}{2}$ inches, but this proportion is very pleasing to the elderly people and heavy set people and has caused much favorable comment. The interior is well lighted with windows, glass brick, and electric lights. Numerous wall plugs have been provided, with both single and three-phase power for the use of exhibitors. Large rest rooms, built-in concession rooms, drinking fountains and offices for the Fair Secretary have also been provided in this building. The three stair ways to the deck are provided with doors to keep out rain and wind. All plumbing has been provided for two dressing rooms, to be used if the grounds are later used for athletic events.

The concrete deck is supported by girders and beams which are carried by columns on 20-ft. centers. Seats consist of 3 treated 2 x 4s, placed on angle iron frames that have been bolted to the risers and are 18 inches high with a slight tilt backwards. The risers are 10 inches high with the treads 32 inches wide. This extra wide tread gives good leg room between seats and has been very favorably received. Three broad walks lead to the nine exits and 6000 people cleared the deck in four minutes.



Interior view of stadium, showing type of construction.



Garfield County Stadium nearly completed.

It is contemplated that when funds become available, a steel roof will be built over the deck, so the design has provided certain extra large columns with extra large foundations to receive the roof columns at any future time.

No definite mix for the concrete was specified, but a maximum slump of 5 inches and a minimum strength of 3,000 pounds per square inch in 28 days were required. Full responsibility for obtaining this strength was placed upon the contractor. Three cylinders were taken during each pour and the lowest break was 3,480 pounds. Transit-mix concrete was used throughout.

While the structure was designed primarily in this office, much credit must go to the Portland Cement Association, local plumbers, electricians and the contractor for their cooperation and advice. It was built by the Bass Construction Company of Enid for a contract price of \$159,944. Several changes ordered during construction will raise this price slightly.

On the thirteenth day of September, 1948, the Stadium was dedicated as a memorial to the service men and women in the Spanish-American War, World War I and World War II.

Lining 62" and 36" Pipe

(Continued from page 21)

starting. The contract costs of lining the 62" conduit and 36" main were \$70,967.40 and \$20,662.80 respectively. The excavating, sheathing and backfilling of all excavations where openings were cut in the pipe, and the manipulation of all valves was done by City employees. The cost of this work on the conduit and main was \$8,965 and \$2,539 respectively.

The conduit and main have been in service for approximately one year since being lined and there has been no evidence of leakage through the lined pipe. When the conduit was

first put into service the value of "C" in the Hazen-Williams formula was 124 and after lining it was 141.

It has been estimated that the saving resulting from installing the lining in the conduit due to reduction in cost of maintenance; reduction in loss of water; improvement in carrying capacity; elimination of danger due to the presence of water and ice on the streets from leakage; and the hazards of excavating and making repairs will amount to \$10,370 annually. This represents a return of 13 per cent on \$79,662 invested in lining 16,897 feet of conduit. The Centrline Corporation was represented on the job by Chas. S. Erskine, the National Water Main Cleaning Co. by Walter B. Johnson and the Water Division by Robert J. Verner, Resident Engineer.

Sewer Rental Charges of Several Cities

Redwood City, California, has recently adopted sewer rental charges for single-family dwellings of 60 cents a month inside and 90 cents outside the city limits. Rates for large industrial users are based on the volume of water used. Industrial wastes must be screened; storm and surface waters cannot be emptied into sanitary sewers; churches are not to be charged for sewage; both city water and water from private sources deposited into the sanitary sewer system will be used to determine charges; and the city engineer will determine sewage quantities according to the percentage of water deposited into the sanitary sewers, except that a user may install at his own expense a measuring device subject to engineering and water department approval.

Farmington, Missouri, has adopted a minimum sewer rental of \$1 a month for not more than 300 cubic feet of water, with an additional

charge of 25 cents for 100 cubic feet of water up to the first 5,000 and 20 cents per 100 cubic feet thereafter. Maysville, Kentucky, has set sewer rentals at 50 cents a month for single and multiple-family residences and businesses which use water only incidentally, and \$1.50 to \$5 per month for larger business and industrial users. Cottage Grove, Oregon, has set sewer rental charges at 20 per cent of the water bill. Single-family residences connected with the sewer system but not using city water pay 55 cents a month and auto courts pay 35 cents a month for each unit.

Alamosa, Colorado, has established sewer rentals from 50 cents to \$1 a month and provides a \$100 assessment for each new sewer connection. Louisville, Kentucky, now charges the same rental rates inside and outside the city. More than 125 municipalities in Ohio, now including Cincinnati, use sewer service charges to finance sewerage projects. Sumter, South Carolina, recently increased its monthly water rate 25 cents and established a sewer service charge to finance sanitary sewer improvements: 50 cents a month for a house or 3-unit apartment with one connection, plus 25 cents a month for each additional house or apartment; and businesses, including hotels, \$1 to \$3 per month, plus \$1 for each 100 employees over 100.—*Public Management.*

Functional Airport Design

(Continued from page 24)

amounts to 830,000 revenue ton miles per year or 8,300,000 revenue passenger miles per year!

It is easy to understand why communities with inadequate runway length are not provided with the best and most frequent service by the airlines! Sufficient runway length is a necessity now from the standpoint of airline operation and more, rather than less, runway length will be required in the future as the transport airplane develops. *No other single design consideration is so important as providing enough runway length for fast, safe and economical air transportation!*

That functional design requirements are not incompatible with efficient and economical airport design is clearly demonstrated in the Unidirectional Runway Airport. This type of airport was discussed in the November, 1947, issue of *Public Works Magazine*. It is the only type of airport that will satisfy all of the major functional airport design requirements.

A Report on

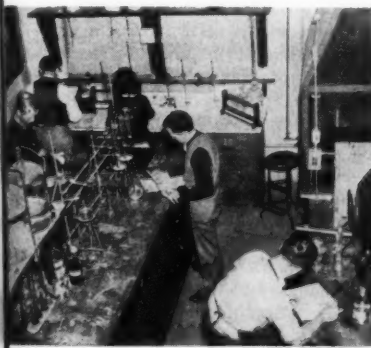
Rapid Analytical Techniques for Water and Sewage

GEORGE W. REID* and ROBERT S. INGOLS**



George W. Reid

IN September, 1946, the Georgia Institute of Technology received one of the first nonmedical grants-in-aid ever made by the United States Public Health Service, to do research on "Rapid Chemical and Physical Analytical Techniques in Water and Sewage Analysis." Investigations under this grant are being conducted, with the supervision of the State Engineering Experiment Station, in the laboratories of the School of Civil Engineering, with the aid of specialized facilities of other schools and divisions of the Institute.



A view of the Sanitary Engineering Laboratory.

In the solution of problems concerned with water and sewage analysis, attempts have been made here to devise new and suitable analytical techniques, as well as to modify such existing ones as are pertinent. Specific accomplishments to date include publication of a paper entitled "An Oxygen Consumed Test for Sewage," describing a modified technique, and acceptance for publication by the American Chemical Society of a paper

on a new calcium analysis technique. A fundamental study has been undertaken on several methods of determining fluoride ions, and the ferric thiocyanate determination was developed sufficiently for use in testing on natural waters. Studies on total nitrogen determination by the microkjeldahl procedure have been completed, and studies on chromium, nitrate, and sulfate ion determinations have been inaugurated. Some fundamental studies on the entire BOD problem, including development of a photometric end-point method for the relative stability tests, have established patterns for further studies, including BOD tests with blended sewage and direct BOD studies with the Sierp apparatus. A bibliography of the literature on water and sewage analysis has been compiled and published.

Water Analysis

The calcium determination uses urea hydrolysis for raising the pH of a solution containing both the calcium and oxalate ions, permitting the formation of large crystals of calcium oxalate. These are less contaminated by magnesium or aluminum oxalate than the small crystals formed by the standard method, while the overall time for a set of duplicate determinations for calcium is reduced, by the use of urea, from 90 minutes to 45 minutes. A report on this work will shortly be published in *Analytical Chemistry*.

An attempt was made to adapt the photocolormeter to the total hardness test. The analyses of a large number of known solutions under varying conditions soon indicated that there were many factors that could not be adequately controlled. Next, the use of the rotating platinum electrode for the determination of hardness was studied, but it was found that this electrode is not responsive. Studies

on the amperometric titration for chlorine are under way. The determination of the nitrate ion with brucine is under way. This work is based on the test now used on boiler water control.

The accuracy of the determination of the sulfate ion with benzidine is limited both by the rather high solubility of the benzidine sulfate precipitate formed and by the adsorption of the excess benzidine dihydrochloride on the filter medium. According to *Standard Methods*, there are both upper and lower limits to the sulfate ion concentrations that should be determined by this technique. A study has been undertaken here to develop reasonable accuracy at lower sulfate ion concentrations.

Sewage Analyses

Chromium ion determination, important in industrial wastes in particular, has been under investigation. An alkaline medium is used to oxidize trivalent chromium to the hexavalent form and a catalyst is used to destroy the excess of the hydrogen peroxide used as the oxidant. The alkali is neutralized, and the colorimetric determination is made under strict pH control. The test requires less time than does the *Standard Methods* technique, and is sensitive to 0.01 p.p.m. of trivalent chromium.

The Biochemical Oxygen Demand (BOD) test is the standard method for measuring the strength of sewage samples, and probably no purely chemical method can ever supplant it completely. However, it is frequently necessary to know the quantity of bacterial food in industrial waste samples that are toxic to bacterial activity, or to have the strength of a sewage sample in less time than the five days required for the routine BOD test. The present permanganate

* Associate Professor of Sanitary Engineering, Georgia Institute of Technology.
** Research Associate Professor of Chemistry, Georgia Tech Engineering Experiment Station.

Leaders in the Public Works Field

Long a recognized authority in public works, Mr. Xanten was elected president of the American Public Works Association at its October meeting. In every-day life he is Superintendent of the Washington, D. C., Division of Sanitation, in which post he has done an outstanding job.



WILLIAM A. XANTEN

Oxygen Consumed (OC) test is the only available procedure that even partially fulfills these requirements.

Work has been completed here on the study of a new oxygen consumed method, using an acid dichromate procedure which was developed for analyzing sewage or industrial wastes. This method is much more accurate than the standard method. Moreover, it uses only simple laboratory apparatus; requires a small sample (10 cc) of material to be tested; is rapid (requires less than two hours for several simultaneous determinations); and gives values for many known substances (such as starch and peptone) which agree perfectly with their true BOD values. The values on raw sewage samples run somewhat high because paper and certain other materials in the sewage are attacked by the reagents used, although they are not factors in biological measurements. On settled sewage and secondary treatment unit effluents, the agreements are very good because the sampling errors are reduced.

A study of the use of the microkjeldahl (Hengar) procedure for total nitrogen in sewage has been finished. Some changes in equipment have been made which have proved helpful, and the micro apparatus is much less expensive and occupies less space than the equipment for regular analysis. Results check within the

sampling accuracy. This technique should be especially useful for laboratories with limited space and only occasional need for total nitrogen values. Analysis was completed on a wide variety of samples, including samples prepared by blending, but publication of results is being withheld pending coordination with work done by L. C. McMurray at Johns Hopkins University.

A year ago, an idea for the accurate timing of the endpoint of the Relative Stability test was conceived. A 4-point electronic recording microammeter was used for this work, and, by using this instrument with a photoelectric cell, it is expected that an exact endpoint for the relative stability test can be studied. This test requires less time than that needed for a regular BOD of raw sewage and should give results which are valuable. For use in a small sewage plant laboratory, it may be necessary to eliminate the expensive electronic recording device; therefore, a relay has been designed, working from the photoelectric cell which will control a time accumulator. Studies indicate, at present, that the method cannot be used as a standard technique in sewage analysis, but the work has established a pattern for additional work on BOD. Sierp apparatus for direct gas adsorption studies of BOD has been obtained, and tests have been run on many

samples to aid in interpreting results. Also, the development of a modified apparatus to measure dissolved oxygen values with a metal electrode is now in progress. This electrode system can be attached to the recorder for studies of the effect of different DO levels upon the rate of oxygen demand and of the differences in the BOD curves of various sewages.

Literature Search

In order to serve as a guide and reference source for work in this field, a literature search on water and sewage analysis was prepared by the Engineering Experiment Station's Technical Information Division. Some 2,560 references were located and classified. In order that this exhaustive search might be made generally available, the bibliographic references have since been published by the Station in the form of a 215-page book, which is extensively cross-indexed under "materials" and "methods."

Close examination of the literature already on hand indicates that, while considerable work on various methods and techniques for chemical analysis has already been performed, little of this work was designed to be usable by the average small water and sewage treatment plant, nor has it been particularly applicable to stream studies. Moreover, some of this previous work predated the development of certain pieces of new electronic and physical equipment. Furthermore, present sewage test procedures indicate the need for increased application of fundamental research in the development of new tests. Although the work on water analysis methods has been more thorough, it has not been as well correlated with plant control or field conditions. In many instances, it appeared that chemical techniques approached the physical ones in speed and simplicity. From the work, on methods, it has become increasingly apparent that work on degree of precision and accuracy desired and attainable should be undertaken as a corollary.

Acknowledgments. — Grateful acknowledgment is made to Mrs. P. E. Murray, E. H. Shaw, and Mrs. J. C. Hildebrandt, research assistants, for their painstaking work, and to Dr. Gerald A. Rosselot, director of the Georgia Tech Engineering Experiment Station, and Prof. T. H. Evans, director of the School of Civil Engineering, for their encouragement and assistance. Acknowledgment is also made to Dr. C. E. Renn of Johns Hopkins University for his advice and interest.



Left, loader dumping into B-G conveyor; right, slackline with Minneapolis-Moline power unit in foreground.

How Modern Equipment Saved More Than It Cost

J. S. SCHMIT

County Engineer, Kittson County, Minnesota

KITTSOON COUNTY, Minn., is situated in the extreme northwest corner of the state, the Dominion of Canada to the north and the State of North Dakota to the west. The west one-third of the county is a part of the famous Red River Valley of the North, consistently producing excellent crops due to its ideal weather conditions and rich, heavy soil. The top soil, commonly called 'gumbo,' makes an ideal dry weather road building material. However, a small amount of moisture will make a road surface exceedingly slippery; and the road becomes impassable with continued rainfall. Thus, in this section of the county, a newly constructed highway must be given an initial surfacing of 800 to 1000 cubic yards per mile of crushed stone or gravel, depending on roadway width. This must be followed by additional treatments of 300 cubic yards per mile every other year. This continued need for gravel on the county system, plus the needs of the state and the various townships, has resulted in a serious drain on the gravel resources of the county. It has not been uncommon during the past years to haul road material a distance of 30 miles and our neighboring county to the south has been obliged to haul gravel up to 40 miles. Due to limited funds together with increased costs of producing and hauling surface aggregate, our county highway surfaces have suffered a gradual deterioration. This has reached the point where as

much as 600 cubic yards of gravel per mile are required on a large portion of our road system in the Valley.

An investigation of several abandoned gravel pits on the easterly border of the "gumbo" area showed a considerable deposit of coarse gravel lying below the water surface. Excavation had been carried to about ten feet below water by the use of draglines, but this was the extent of their operations. These pits, about a dozen in number, extend in practically a straight line, for approximately 8 miles. The area of these pits varies from two to six acres each. The water level in them has remained constant, about five feet below ground elevation, even during long dry periods.

\$10,000 Saved; Equipment Cost \$8,000

In the spring of 1947, the county purchased a used Mead-Morrison slackline; a 57-foot by 18" Barber-



A typical gravel pit.

Greene conveyor; and a Minneapolis-Moline tractor equipped with a 1/2-cubic yard Lull Shovel-Loader. This equipment, which cost us \$8,000, was set up at one of the northerly pits and 15,000 cubic yards of excellent road material were removed from an area of about one acre. In 1948, about 13,000 cubic yards were processed in this same pit. The deepest point in the excavation below water was recorded at 30 feet and there was no indication that the bottom of the deposit had been reached. Securing surfacing material at this point in the county provided a saving of slightly over \$10,000, due to shorter haul.

This chain of pits, lying in the same direction as the general slope of the land, leads one to believe that an ancient river existed along the line of these gravel deposits. This theory is borne out by the fact that a slight current is noticeable at times, and the absence of vegetation, usually found in stagnant bodies of water, is also an indication of a continual flow of fresh water. However, there is no apparent outlet for the underground stream to the northwest. Another theory which is widely accepted, is that this series of outcroppings of gravel is the last easterly shore line of receding Lake Agassiz, which, in prehistoric times, covered a large portion of Kittson County and other adjoining areas. This lake was formed by the melting of the ice of a large glacier.

The experience gained during the past two years has aided substantially

in reducing the cost of producing material. Only two men are required to operate the equipment on each shift. The cost per cubic yard of gravel in the stockpile has dropped from 35 cents in 1947 to 25 cents this season, due to more efficient operation.

Thus an investment of \$8000 in equipment has paid big dividends to the county. Our supply of gravel has been greatly increased by utilizing these abandoned pits. Reducing the length of haul by ten miles is an important saving, not only in actual dollars, but indirectly through the

elimination of heavy maintenance costs on these miles of hauling saved through our operations. We can now anticipate a marked improvement in the condition of the surfaces of our gumbo roads in this section of the county. Our investment in modern equipment has paid well.

Special Tools Aid in Repairing Sewer

THE engineering department of Cudahy, Wisc., of which Carl C. Schabla is city engineer, recently developed two cost-saving devices for salvaging and repairing a relief sewer that had been seriously damaged by highly corrosive waste material from a drop forge plant. This waste, which had practically destroyed the sewer inverts, contained considerable sulphuric acid from the pickling vats. The sewer varied in size from 15-inch to 48-inch.

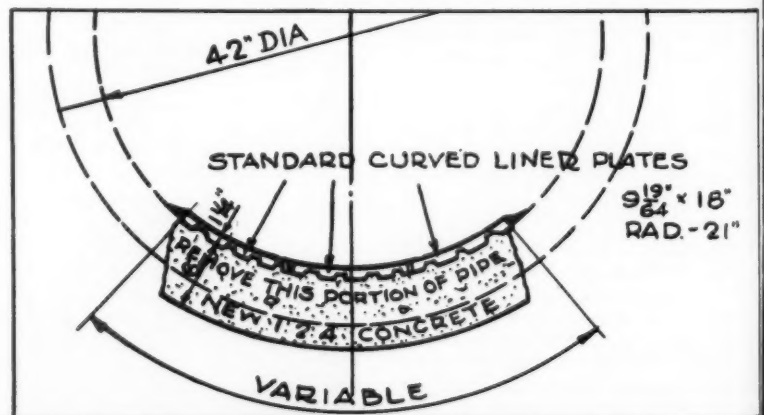
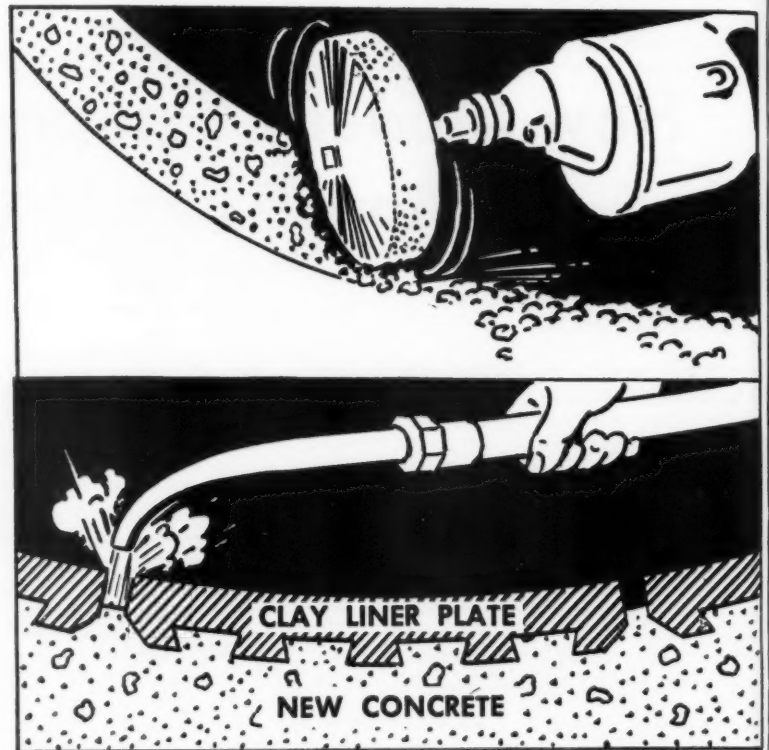
Investigation showed that vitrified clay lines had not been affected by the acid waste. Consequently, it was decided to replace the 30-in. and smaller lines with clay pipe; but in the 36-in. and larger sections, where there was room for a man to work, it was necessary only to replace the invert. Vitrified clay liner plates, set in concrete and joined with an acid-proof asphalt compound were selected for the invert lining.

Developing Special Tools

To cut away the softened or destroyed portions of the sewer invert, a portable rotary electric hand drill was equipped with a stiff steel brush. This was used not only to remove the material that had been softened by the acid, but also to assure a clean contact surface for the new construction.

The other device developed for the work resembled a dentist's air nozzle, considerably oversize, of course. Compressed air was carried through a hose to a special nozzle made of a piece of pipe flattened at one end to form a slotted opening. This nozzle was inserted into the space between the liner plates, completely drying all of the surfaces. Immediately after this drying process, the spaces were filled with acid-proof jointing compound. As a precaution, the inside of the original sewer was painted with the same compound for some distance above the new invert.

Liner plates were generally installed over the bottom third of the sewer.



How 42-inch pipe was salvaged and clay liner plates placed for protection. Top, removing the old section; middle, air drying before placing the asphalt compound; bottom, the completed job.

The Place of the Sanitary Engineer in Industry

An abstract of a paper by the same title presented by Lloyd K. Clark, Project Manager, Sanitation Research Project, Association of American Railroads, at the annual meeting of the Kentucky-Tennessee Section of the A.W.W.A. and the Kentucky-Tennessee Industrial Wastes and Sewage Works Association held in Chattanooga August 25, 1948.

INDUSTRY in this country means capital investment, and profits are necessary if industry is to exist. Therefore, any discussion of the place of the sanitary engineer in industry must take stock of the financial return, direct or indirect, which he can render. To suggest to industry the employment of an engineer will provoke the inquiry: "Will he be an asset or merely a liability in a business organization which must depend on profits for continuous operation?" For wider employment of sanitary engineers in industry, there must be a satisfactory answer to this question.

There are three categories in which such engineers may serve industry: In private practice; in association with industry, though employed outside of it; and in full-time industrial

employment. The first case, where the engineer is normally retained because of an immediate need for new or improved sanitary facilities, is well covered by existing rules and tenets of practice. The engineer has an obligation to serve his employer but not in defiance of the public welfare.

Sanitary engineers employed by States, cities, counties and the Federal government frequently have many duties touching upon industry, as stream pollution and the control of environmental sanitation. These engineers have broad responsibilities which are too often neglected. In their recommendations or requirements, they must be reasonable; and most of all they should attempt to work with industry. It is often possible for them to point out the advan-

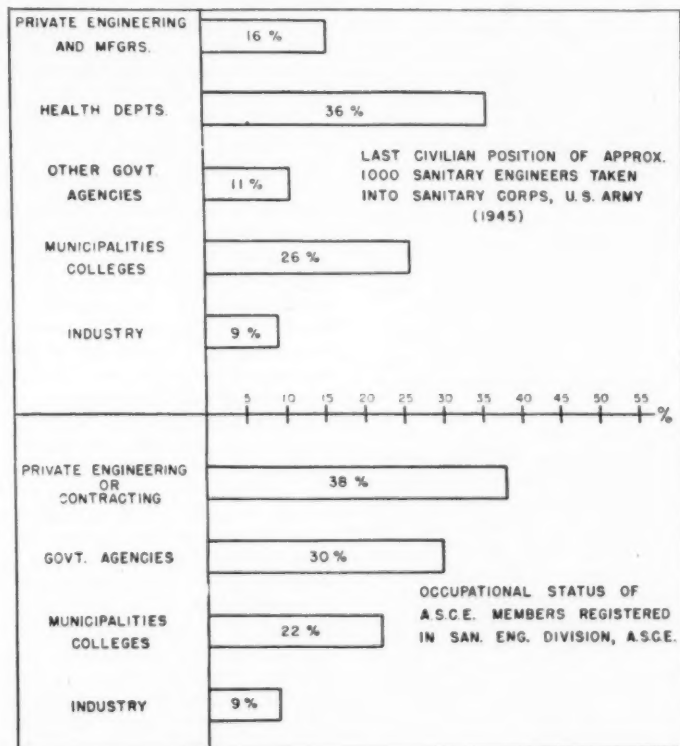
tages accruing to industry by the employment of a qualified engineer to solve these problems on a basis fair and satisfactory to everyone. The State sanitary engineer, for instance, cannot solve problems for industry; that is industry's job. Control measures can rarely be instituted on the basis of theory alone.

The Need for Engineers

Probably the best cure for the sanitation ills of industry is for industry to develop a staff of qualified men trained in this field, including not only sanitary engineers but also chemists, bacteriologists, industrial hygienists and similar professional personnel. Some industries are already committed to sanitary programs. For example, the oil industry in foreign areas where sanitation is lacking, maintains sanitary engineering and entomological services, though it has overlooked the obvious need for similar personnel in this country. The baking industry uses engineers in maintaining and protecting the cleanliness of its products; and the canning, packing, paper and chemical industries employ professional men for solving waste treatment problems.

Other industries, however, have made limited use of sanitary engineers. Land and air carriers, for instance, despite tremendous capital investments and volumes of passengers and goods handled, have employed sanitary engineers very rarely. The needs for safe water supply, satisfactory waste disposal and insect and rodent control have been handled largely by medical and operating departments and have not commonly been segregated into a sanitary engineering department.

The cost of employing adequate engineering skills may be a problem to the smaller industry, unless the engineer can quickly provide a positive return on the investment in him—and this is not often possible. The many trade and industrial associations offer a solution, in that funds from the entire membership may be pooled to provide a central point of investigation and study, adequate equipment and capable personnel. Such an arrangement reduces duplication of effort and saves money. It can be made more effective if, within



Distribution of two groups of sanitary engineers.

each organization, there still remain trained personnel who report intelligently to the company authorities on the activities and progress of the central agency. Such personnel may also furnish guidance to the central group, supply data on field tests, etc.

How Engineers Can Be Used

The Manufacturing Chemists' Association has recently developed a useful guide for its members. This guide recommends that responsibility for such matters, for instance, as waste disposal, be assigned to a high company official. It recommends the employment of specialists in industrial waste disposal and calls attention to the need, in a company research and development program, for studies on methods of disposing of the wastes that may be produced. It considers the need for engineering skills in the design of new plants or the enlargement of existing plants. It outlines a method of working out waste treatment problems with a minimum investment. In the selection of a plant site, it advises full consideration of water supplies, waste disposal and freedom from conditions likely to cause disease.

These same factors are applicable to other industries and to other problems. It is of particular importance that the engineer is not relegated to the lower levels of responsibility. Not only does this tend to obstruct action on his recommendations, but it detracts from his value to the company in outside dealings. When the engineer is respectably placed in the organization he is in a far better position to meet outside regulating agencies and to exert more influence in presenting the industry's side of the question. The outside agencies, on the other hand, appreciate a sympathetic viewpoint within the industry and are more likely to act cooperatively on problems affecting it.

Engineers in Industry

There are few data on the number of sanitary engineers engaged in industrial work. The roster of the Sanitary Corps of the Army, as of 1945, included approximately 1000 officers qualified as sanitary engineers. The listings showing the last civilian occupation before entering the Army gave the following breakdown: Health departments, 36%; consulting engineers and manufacturers of sanitary equipment, 16%; governmental agencies, 11%; industry, 9%; and municipalities, colleges, miscellaneous, etc., 26%. A similar breakdown of the membership of the Sanitary Engineering Division of the ASCE, shows: Private engineering and contracting, 38%; local, State

and federal agencies, 30%; municipal and college, 22%; and industrial and manufacturing, 9%.

What One Railroad Does

The railroads employ few sanitary engineers; as far as can be determined, there are 3 railroads which specifically designate the position and title of Sanitary Engineers. In the Sanitary Corps listing above, 8 engineers came from railroad service. There is, however, one outstanding example of the broad and gainful use of a sanitary engineer, H. W. Van Hovenberg, by a railroad (The

Cotton Belt). Following are some of the duties assigned to him:

Safe drinking water campaign; certification of water supplies; water treatment; sewage disposal; other waste disposal; malaria control (a pioneer job by this railroad, which has paid off remarkably); rodent control; sanitary control in time of floods; car sterilization; sanitary control of passenger cars; general sanitation of all railroad premises, shops, work trains, etc.; operation of sanitary laboratory; boiler water supplies; and other related jobs.

Choosing Paints for Sewage Plants

THE Division of Sanitary Engineering of the Illinois Department of Public Health, in cooperation with the Sanitary Water Board, issues quarterly "The Digester," "To promote the installation and efficient operation of sewerage systems." In the issue for the second quarter of 1948 appeared a "Catechism of Paints and Protective Coatings" contributed by Walter A. Sperry, Superintendent of the Aurora Sanitary District, in which are given, in the catechism form, a great deal of information about the nature of paints, varnishes and other coatings, vehicles, pigments, etc. We have extracted from this those paragraphs which seem most pertinent to the selection of paints for use around sewage plants.

Around sewage treatment plants, lead pigments are not desirable because they discolor from hydrogen sulfide gases. Zinc pigments alone are not desirable because they tend to be too hard and flinty. Lead pigments alone tend to be too chalky. A combination of lead and zinc pigments relieves the bad properties of both.

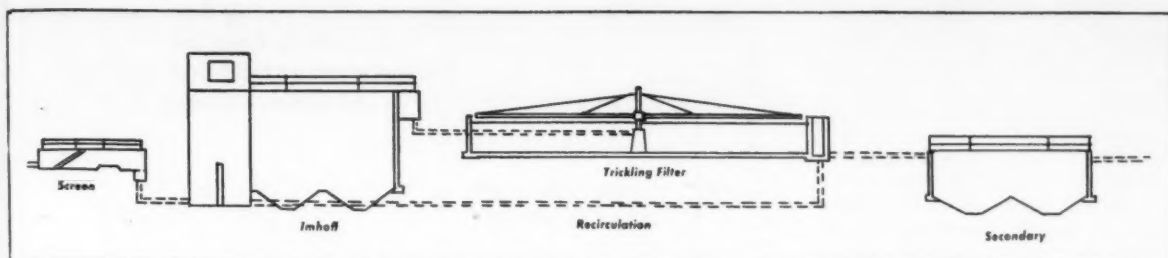
Aluminum paints are a modern and highly valuable addition to the family of protective coatings. Aluminum powder, usually more or less flaky in character, is floated either in oil varnish, which dries chemically, or in lacquer, which dries by evaporation. The important ingredient of the aluminum paint mixture is the vehicle, which determines its adaptation in use. Oil varnish vehicles are best employed where temperature, up to 1200° F., is a factor.

Lacquer vehicles are best for use where quick drying is desirable and

temperature is not a factor. Over-emphasized advertising leads one to believe that an aluminum paint can be used anywhere. This is untrue. Aluminum paints should be carefully selected for the particular use intended.

There are two general groups of bituminous paints: (a) Those using asphalt as a base derived from the distillation of crude oil or from natural deposits found in the earth, and (b) Those derived from tar which is distilled from coal and wood tar. The tar enamels are best used for underwater protection. The asphalt enamels and coatings are best used for open air protection.

Concrete surfaces must be sized before paint can be applied successfully. Ordinary linseed oil paints tend to disintegrate quickly when applied to concrete surfaces because of the presence, thereon, of calcium hydroxide (a strong alkali) that tends to saponify and so destroy the effectiveness of the vehicle as a binder. One approach to correcting this problem is called the Macnichol process. Here the concrete surface is first treated with zinc sulphate, which converts the alkaline calcium hydroxide to calcium sulphate, and neutralizes its effects. When soaps are applied, the lime coating is converted to stearates or insoluble calcium soaps which deposit in the voids of the concrete and promote waterproofness. Sylvester alternates solutions of alum and soap to create deposits of insoluble aluminum hydroxide in the voids and achieve similar waterproofing properties. Another method makes use of sodium silicate (water glass) which tends partly to form mono-calcium silicate and gelatinizes as silica in the voids of the concrete.



Section through Okawville treatment plant.

Treatment Plant Handles Sewage and Industrial Waste

J. PAUL RHOADS

Caldwell Engineering Co.

CONSTRUCTION work was begun on January 5, 1948, on a complete sewage treatment plant for Okawville, Ill., by the Thomas J. Sheehan Company of St. Louis, Missouri. Plans for this improvement were prepared by the Caldwell Engineering Company of Jacksonville, Ill. Okawville is located approximately 35 miles Southeast of East St. Louis. It is a community with approximately 760 population. There are mineral springs within the Village and people from the entire nation make periodic trips to the two large hotels in the Village to take advantage of the

mineral baths. The Village is also located in the St. Louis milk shed area and two large dairies are located here which process approximately 200,000 pounds of milk daily.

In the past there has been no community sewerage system. Waste from the hotels and the dairies was discharged without treatment into a creek at the edge of the village. Stream pollution and odor nuisance were at a maximum under these conditions. A complete sewage collection system is under construction in connection with the treatment plant, which will consist of a screen cham-

ber, control building and pumping station, Imhoff tank, trickling filter, secondary tank and sludge beds.

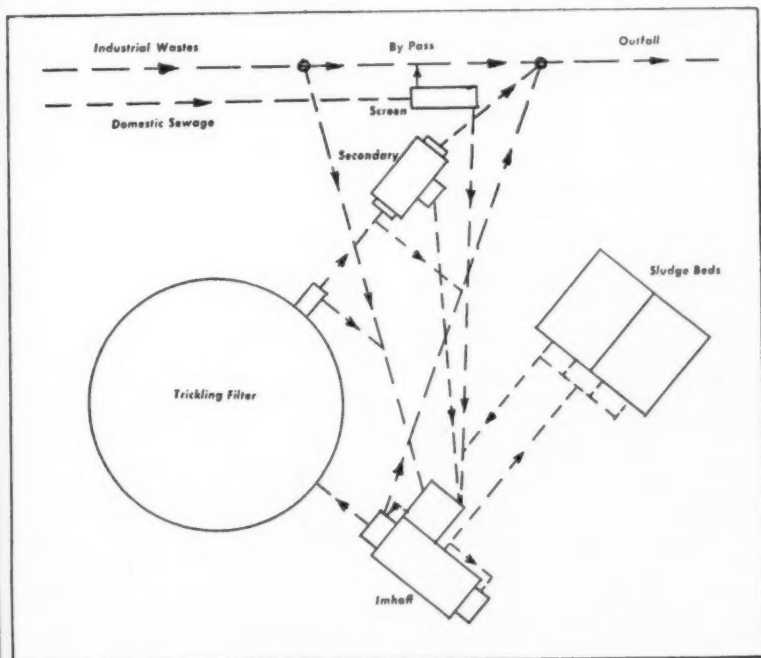
Preliminary Treatment Devices

The screen chamber is equipped with a Chicago 7A comminutor for cutting sewage solids and with an emergency bar screen. Sewage flow is measured by a Parshall flume and a Republic Open-Channel flow meter with register located in the control building. Only domestic sewage passes through the screen chamber, the dairy wastes reaching the plant through a separate sewer line. The wet well in the control building is separated into two compartments, one for domestic sewage, the other for dairy wastes and recirculated effluent from the filter. Discharge from these wet wells is into the Imhoff tank and the dosing tank respectively.

The pumping station is equipped with three Chicago vertical, centrifugal, open shaft pumps of 150 gpm capacity each. One pump handles only domestic sewage; the second handles only dairy wastes and recirculated filter effluent; while the third may be used singly for either operation, or used in parallel with either of the other two. The pumps will be automatic in operation, and will be equipped with alternators automatically to transfer operation between the pumps.

Settling and Filtration

The Imhoff tank will treat only domestic sewage. It is therefore of standard design with the exception that additional sludge storage space is provided on account of sludge from the dairy wastes which will reach the Imhoff from the secondary



Layout of Okawville plant.

tank. A 2½-hour retention period is provided with an expected reduction in BOD of 30 percent. Effluent from the Imhoff discharges into a dosing tank from which it is discharged upon the filter.

The trickling filter is designed on a basis of 1200 population, with a flow of 100 gals. and 0.17 pounds BOD per capita. Allowing for 30 percent BOD reduction in the Imhoff tank the total BOD to be applied on the filter is 143 pounds. However, the BOD from industrial wastes, in this particular case, amounts to an additional 370 pounds, all of which will be applied on the filter.

The filter is designed on the Accelo-Filter principle with provision for recirculation of filter effluent. Flow of domestic sewage is through the Imhoff tank and filter, after which 50 percent is returned to the wet well containing the dairy wastes.

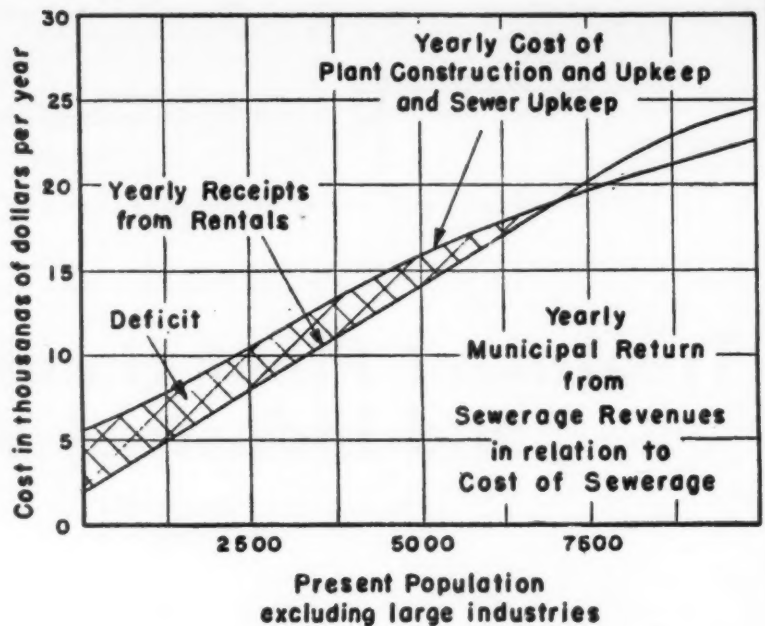
This mixture is then pumped into the dosing tank and passed through the filter; 50 percent of this effluent is again returned to the wet well for recirculation while the balance passes on to the secondary tank. Recirculation and accompanying higher filter loading permits the use of a smaller diameter bed with a consequent saving in cost, and also provides increased biological filter efficiency, elimination of odor and elimination of gnat and fly nuisances. Another distinct advantage is the flexibility available in case of overload, with no increase in size of the sedimentation tanks. The filter will be equipped with an Infilco rotary distributor of 450 gpm capacity.

The secondary tank is rectangular in section without mechanical sludge collection equipment. It is designed for 1½ hours retention. Secondary sludge is returned to the domestic sewage wet well by gravity, there to be pumped into the Imhoff tank. Effluent from the sludge drying beds is also returned by gravity to the domestic sewage wet well.

Automatic by-passing of the entire plant is provided in the event of power or equipment failure. In addition any one of the various units may be by-passed at the will of the operator.

Plans for Airports

A class II airport, estimated to cost \$100,000, is being designed for So. Boston, Va., by Lublin, McGaughy & Associates, Norfolk, Va. An airport to cost about \$300,000 is being designed by R. F. Pyle, engineer, Newport News, Va., for The Peninsula Airport Commission, Newport News.



Average sewerage costs and charges in 24 communities.

How High Should Sewer Rentals Be?

The method of paying for sewerage costs, by making a separate charge or rental for this service, is rapidly acquiring general use in municipalities. The usual method of collecting waste disposal charges is to increase the water bill either proportionately or by the use of a fixed charge per month, depending on the volume and character of the "dirty" water.

The sewer rental charges are used to retire the cost of sewer maintenance, waste treatment plant construction and maintenance costs. As the cost of these items does not vary proportionally as the population in a community, the smaller the community, the higher the rental charge must be in order to pay for these services.

The amount of rental charge has been pretty much established in Minnesota by general usage or custom. In general, the customary charge is \$1.00 per month per residence in towns below 2,000, 75 cents per month per residence in communities between 2,000 and 7,000, and a gradually reducing scale above these population figures. Business establishments, not producing material wastes, are charged about 25 cents a

month above these figures; restaurants, taverns, small hotels, garages, filling stations, grade schools, etc., are usually charged about \$5.00 per month. Industries producing large volumes of waste are normally charged the additional cost of servicing and treatment over what costs would be were the industry omitted. This method is based upon the theory that the industry will pay a general tax and in addition will benefit the community as a whole.

The graph, herewith, based upon the analysis of twenty-four communities, indicates that, in general, the customary charges will retire all costs in communities above a population of 7,000 but below this figure, using the common charges in general use, additional money must be obtained from some other source. In the computation of treatment plant construction and operation costs, the graph is based upon the recently published "Cost of Waste Treatment Plants" by Banister & Ellison. These cost figures are for the lowest over-all costs of treatment and any increase in these costs will increase the rental charge proportionally.

The above is condensed from an article by Hugh C. Leible and R. L. Smith in *Minnesota Municipalities*.

Consulting Engineers Report on Water and Sewerage Work

Sewerage and Sewage Treatment

Alvord, Burdick & Howson, Chicago, have completed plans for a 20 mgd activated sludge plant for Canton, O.; bids will probably be called early in 1949. Bartels & McMahan Engrg. Co., Dubuque, Ia., will call for bids in February for a sewer system and treatment plant for Garnaville, Ia. Plans for a sewer system and for a primary treatment and chemical precipitation plant to handle both industrial and domestic wastes are being prepared for Campbell O., by Floyd G. Browne & Associates, Marion, O. The same engineers are planning sewage treatment plant additions for Marion and bids will soon be called for equipment; they are also planning additions to the Troy, O., plant, which will cost about \$450,000.

Davy Engineering Co., La Crosse, Wisc., has designed a sewer system and treatment plant for Ontario, Wisc. Bids were recently called for the construction of intercepting sewers and a treatment plant for Clyde, O., Finkbeiner, Pettis & Strout, Engrs., Toledo. Greeley & Hansen are reporting on a number of projects, including sewage treatment facilities for the North Shore Sanitary District, Waukegan; and on a sewer system for Oak Park, Ill. C. N. Harrub Engrg. Co., Nashville, Tenn., is designing a waste disposal plant for a packing company at Nashville. A sewer system and treatment plant for North Bend, Ore., including full treatment and sewage lift stations, are being designed by A. D. Harvey and S. C. Watkins, Medford, Ore.; cost will be about \$350,000. Henningson Engrg. Co., Omaha, recently called for bids on a storm sewer and a relief sewer for Council Bluffs, Iowa.

Rollin F. MacDowell, Cleveland, Ohio, is in charge of trunk sewers and treatment plant for Fremont, O.; a sewage treatment plant for Oxford, O.; trunk sewers and treatment plant for Sheffield Lake, O.; and sewage treatment plant improvements for Barnesville, O. An institutional plant to cost \$50,000 is also pending. A sewer system and treatment plant to cost about \$1,178,000 is being designed by Parker & Hill of Seattle, Wash. This is for the Greenwood

Ave. Sewer District. It will involve 40 miles of 8" to 24" concrete pipe and an outfall to deep water. The same engineers are also handling the design and construction of a sewer system for Lake City Sewer District, which is estimated to cost \$7,800,000.

Russell & Axon, St. Louis, call for bids this month for sewer extensions and treatment plant improvements, total cost \$1,300,000, for Belleville, Ill. Charles H. Sells of Pleasantville, N. Y., is engineer for sewer and water installations for that city. C. E. Stockman of Baker, Ore., called for bids in December for a sewage

treatment plant for Nampa, Ida., estimated cost \$400,000. Bids will be called this summer for the construction of a sewage treatment plant for Thermopolis, Wyo., capacity 0.6 mgd.; also for a 2.0 mgd. plant for Rock Springs, Wyo.; Robert L. Streeter, Casper, Wyo., is consultant on both jobs. Taylor & Taylor, Los Angeles, Calif., have completed an engineering report for Flagstaff, Ariz., recommending an over-all sewerage plant. Paul A. Uhlmann & Associates, Columbus, O., will ask for bids soon on extensions for the Columbus sewage treatment plant to cost \$750,000 or more, including 8 85-ft. tanks, floating and gas holding covers and other work. Emerson D. Wertz & Associates, Bryan, O., is making a preliminary study of a sanitary sewer system and treatment plant for Holgate, O. Wilson & Co., Salina, Kans., are engineers on a 7 mgd. plant for Salina. Wilson & Anderson, Champaign, Ill., are asking for bids on a sewer interceptor for the University of Illinois.

Plans for New Water Works Improvements

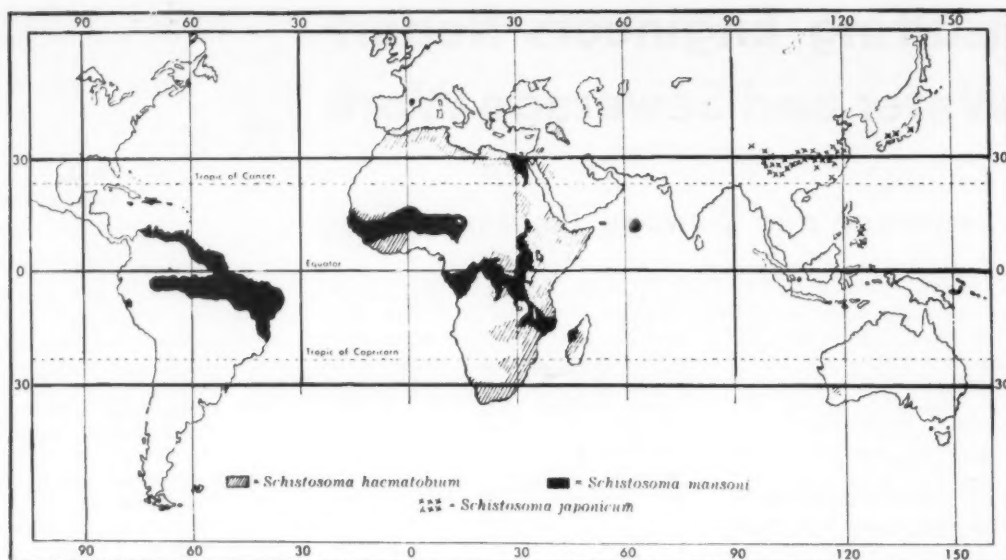
Contract for the construction of a swimming pool, 80' by 120', for Elmira, N. Y., was let last October. Wesley Bintz, Lansing, Mich., was consultant on this job. He has also recently called for bids for pools of similar size at Butler, Pa., and Dixon, Ill. Buck, Seifert & Jost, New York, are consultants on the electrification of the water works station of East Orange, N. J., and are reporting on the water works system of Lockport, N. Y.

J. V. Curnutte, San Antonio, Tex., is consultant for a water supply and distribution project for Poteet, Tex. Water main extensions in Caledonia, Minn., are being handled by Davy Engrg. Co., La Crosse, Wisc. L. J. H. and L. Phaon Grossart, Allentown, Pa., are planning an additional water supply for Walnutport, involving pump, pipe and chlorinator. Hitchcock & Estabrook, Inc., Minneapolis, will ask for bids next month on a water distribution system for Onamia, Minn. Bids will be called during the coming spring for water works additions for Upper Sandusky, O., Jones & Henry, Engineers, Toledo, O. Water works improvements for Highlands, Tex., are being planned by R. W. Kelley, Jr., Houston, Tex.

Donald Mills, consulting engineer of Selma, Ala., is about to ask for bids on water works improvements to

cost \$125,000 for Demopolis, Ala. Parker & Hill, Seattle, are engineers for a pumping station for Leavenworth, Wash., and are handling the reconstruction of the King County Water District No. 23 distribution system. Additions to the Wyandotte, Mich., filter plant are being constructed under the supervision of Pate & Hirn, consultants of Detroit. W. B. Rollins & Co. will be ready for bids about April for treatment plant extensions, Milan, Mo.

Water and sewer improvements for Lake Jackson, Tex., have been designed by S. A. Russell of Rosenberg, Tex. Preliminary studies for the improvement of the water works of Clarksville, Tenn., possibly including a 4 mgd plant, are being made by J. Stephen Watkins of Lexington, Ky. Water works extensions for Silver Lake, Ind., Emerson D. Wertz & Associates, Bryan, O., engineers are about ready for bids. Weston & Sampson of Boston are in charge of additions to the treatment plant and the distribution system for the University of N. H. and the town of Durham, N. H.; for water supply for Franklin, N. H.; and for industrial water supply main for Stoneham, Mass. All contracts have been let. Ralph L. Woolpert Co., Dayton, O., are planning for the water needs of a 6 sq. mile area in Montgomery Co.



Courtesy Dept. of the Army.

Geographical distribution of the three types of schistosomiasis.

Schistosomiasis Control as an Engineering Problem

E. J. HERRINGER

Senior Sanitary Engineer, U. S. Public Health Service

This article is based on a paper presented by the author before a meeting of the Engineering Section of the American Public Health Association.

SCHISTOSOMIASIS challenged the attention of public health authorities during the war when many of our troops were stationed or fought in endemic areas throughout the world and it was found that many men were becoming infected. The possibility that the disease would be introduced into the United States by returning troops and civilians stimulated research into means of prevention and control. Because of the methods of spread of schistosomiasis through infected waters, engineering methods offer definite opportunities for control.

Schistosomiasis is a disease produced by one of three specific blood flukes: *Schistosoma mansoni*, *S. haematobium*, and *S. japonicum*. The flukes live in the abdominal veins and the eggs are expelled in the urine or feces. The intermediate hosts in the life cycle of the schisto-

somes are fresh water snails, of which several species have been implicated. Of the three schistosomes, *S. mansoni* is of the most interest to the United States because it is prevalent in Puerto Rico and other Caribbean areas, from whence thousands of people annually come to this country. Moreover, in some of the southern United States, there is a snail which is known to be suitable for the development of this fluke.

Schistosomiasis, when produced by *S. mansoni*, causes intestinal lesions; symptoms resembling dysentery, chills and fever; and other manifestations. It is contracted by wading, swimming or working in water courses, whether streams or ditches, infested with the cercariae of the schistosomes. Drinking of infected water may also cause disease. The method of spread of schistosomiasis therefore makes the disease a sanitary hazard associated with the domestic, industrial and recreational use of water sources.

Methods of Spread

The feces of infected persons contain the eggs of the fluke. Within a few hours after discharge into fresh or brackish water, the majority of the ova passed in the feces are ma-

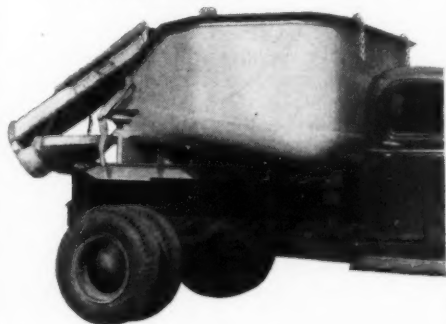
ture. As soon as the next stage, the miracidium, develops from the eggs, it escapes and seeks the snail host, which it penetrates. The period of development of cercariae in the snail is about 28 days, after which time the cercariae emerge; but their free-living existence thereafter does not exceed 48 hours.

Within 15 minutes after a person has emerged from infested waters, the cercariae will have penetrated the skin. While penetration may be accompanied by a pain, similar to that from pin pricks, it may be accomplished without any sensation whatever.

The chief endemic areas of schistosomiasis are located in (1) parts of China, the Philippines, Formosa, Japan and the Celebes; (2) Africa, Greece, Portugal and the near east; and (3) Venezuela, parts of Brazil and several of the Caribbean islands. At the present time no foci of schistosomiasis are known in North America, but studies have shown that there are four known snail hosts suitable for the development of *S. mansoni* in the western hemisphere. These are: *Australorbis glabratus* in Puerto Rico, parts of South America and some of the Caribbean Islands; *Tropicorbis havanensis* in Louisiana

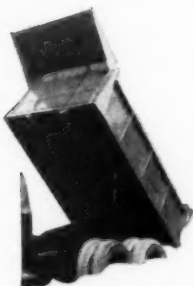


Hercules WD-12 Dump Body, equipped with Hercules 7X "Center-Lift" Hoist. Note integrated underbody construction, with crossmembers and longitudinal welds into a single, exceptionally sturdy unit.



Hercules Heavy-Duty Dump Body, mounted on six-wheel chassis, with Hercules 8X Hydraulic Hoist. Body, of 10-gauge steel, measures 144" x 84" has a capacity of 8 cubic yards. "Center-Lift" principle, originated by Hercules, insures smooth, easy lifting of large capacity loads.

The Hercules Aircrater, revolutionary new unit for hauling and placing premium-quality, air-entrained concrete, is equipped with a Hercules 8X "Center-Lift" Hydraulic Hoist for fast, clean dumping of concrete.



**X = { SMOOTH,
POWERFUL
HOIST
ACTION**

The HERCULES Type X "Center-Lift" Hydraulic Hoists

Smooth, powerful lifting action—that's the advantage of the "Center-Lift" principle, pioneered by Hercules and developed to its most efficient stage in the precision-built Hercules Type X Hydraulic Hoist.

Hercules "Center-Lift" provides maximum lifting capacity with minimum use of power, prevents cramping and eliminates strain on body and hinge bolts—features that make your most difficult hauling and dumping jobs easy—and profitable.

Whatever your hauling and dumping problem, you'll find an economical solution in Hercules Hydraulic Hoists and Dump Bodies—engineered for dependable, low-cost performance on any job. Write, outlining your requirements, for complete information.



Hercules D-12 Contractor's Body, sturdy unit for all-around work. Pyramid-type enclosed steel side braces and full-length rub rails for maximum strength.

**LIFT WITH EASE—
USE**



STEEL PRODUCTS CORPORATION • GALION, OHIO



HYDRAULIC
HOIST



CONTRACTOR
BODIES



LOW-MOUNT
BODIES



GARBAGE
BODIES



COAL
BODIES



TRAILER
BODIES



CONCRETE
BODIES



LIME
SPREADERS



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and Texas; *Tropicorbis centimetalis* in parts of Brazil; and *Australorbis antiguensis* in Antigua, St. Lucia, St. Martin and St. Kitts. Other species of snails are under study as possible hosts, but have not yet been definitely implicated.

No data are available as to the number of carriers in this country. Possible carriers may include military and naval personnel that have returned to the United States from service in endemic areas; but in addition, several thousand people enter the United States each year from Puerto Rico and Venezuela. It appears probable, on the basis of incomplete data, that 12% or more of the population of Puerto Rico is infected, while the figure is possibly 20% for Venezuela.

Control Measures

Control of schistosomiasis can be accomplished only by breaking the life cycle of the schistosome, and this is perhaps best accomplished through environmental control. An attack of the disease does not confer immunity; there is no known available preventive; and until recent years no effective treatment was known. Treatment with certain trivalent antimony compounds has resulted in cures in a fairly high percentage of cases.

The principles of environmental control of schistosomiasis are: (1) to prevent the discharge of schistosome ova into water courses; (2) to rid streams and ditches of the snail hosts; (3) to kill cercariae in infested waters; and (4) to protect exposed populations from contact with infested waters. In endemic areas, all of these principles should be applied simultaneously for no one method will accomplish conclusive results.

Sanitary disposal of sewage and protection of water supplies are basic requirements; but these methods, which have proved effective in the control of enteric diseases, may have to be supplemented by specific methods for the removal or destruction of eggs and cercariae. It is generally recognized that ordinary pressure or rapid sand filters will not prevent the passage of the cercariae. As early as 1915, it was found that cercariae penetrated 30 inches of the finest grain sand used in the water works of Cairo, Egypt. Beginning in 1943, diatomaceous filters were tested. It was found that only a shallow filter depth, such as was normally used for water filtration, was required to prevent passage of the cercariae. A filter unit using pads was also tested, and no cercariae were recovered from

the effluent. Further research of this type is needed. Chlorination, which is discussed under Chemical Control Methods below, has also been demonstrated to be very effective.

Rigid control of stream pollution would probably be the most effective single method of controlling the disease, but this would require satisfactory disposal and treatment of sewage in rural as well as in urban areas.

Sewage treatment processes are not effective in the removal or destruction of schistosome ova and miracidia. Studies have been initiated by the Division of Tropical Diseases of the National Institute of Health, but no conclusive results have been obtained. Rural sanitation, to be effective in preventing schistosomiasis, requires not only the provision of sanitary toilets and the prevention of ground pollution, but also the protection of water supplies.

Ridding streams of snails has been proposed as one method of control. This is difficult, though the harborage of snails in a stream can be greatly curtailed by canalizing the stream and maintaining a clean channel. A stream flow velocity of 20 to 60 ft. per minute, minimum, is necessary.

Methods of Chemical Control

Treatment of infested streams to destroy either or both the cercariae and the snails has been attempted, but without marked success. Lime and copper sulfate have been used. Lime at 50 ppm. to 70 ppm. is ineffective; 500 ppm. is effective, but renders the water unsuitable for other uses. Copper sulfate at algacidal doses (up to 1.0 ppm.) will kill cercariae but has no deleterious effect on the snails; however, 20 ppm. is toxic to the snails.

Chlorination appears to be the most effective treatment known at present, and the concentrations required to kill the cercariae are small. Experiments conducted in Puerto Rico have shown that the cercariae of *S. mansoni* exposed to a residual chlorine concentration of 0.50 ppm. for 20 minutes were killed; concentrations of 1.25 ppm. produced the same result in 4 minutes. High-test hypochlorite killed the cercariae in about 10 minutes with a residual of 0.50 ppm.; and about the same results were obtained with Halazone and Bursoline No. 3 (an iodine compound), though the time required for killing was slightly longer.

Chlorination is effective in the treatment of water for drinking or bathing purposes, but it is difficult or impossible to apply it to streams or other uncontrolled waters.

There is definite need for additional research on chemical or biological control, to find a compound which will kill the snail yet will not be injurious to man or to useful living things, and will not interfere with the use of the water.

Summary

Health authorities in the United States repeatedly have expressed concern lest veterans returned from endemic areas, or immigrants from countries where this disease is endemic, transplant the disease to our states or communities. Since the discovery of a suitable snail host in the southern states, interest in this potential hazard has increased. In areas where the intermediate host is found, the chances that schistosomiasis will be established are greater, for in these areas the environment more closely approximates the environment of the endemic areas of the Western Hemisphere.

Our present knowledge of schistosomiasis and the methods of its control indicates that no fundamentally new and costly procedures are needed to prevent the establishment of this disease. If proposals required to meet sanitation needs in all parts of the United States are provided, adequate sewage treatment and safe water supplies will provide the first and strongest bulwark against schistosomiasis. The situation may be summarized as follows:

1. Schistosomiasis is a serious health problem in many parts of the world. The possibility of its introduction into new areas has been increased by the movement of populations during and since the war.

2. The spread of schistosomiasis to new areas is restricted by the absence of a suitable snail host, but one of our North American snails has been found suitable for the development of *S. mansoni*; and other snails found in Latin American areas are known to be suitable.

3. Environmental sanitation measures offer the most effective methods for controlling schistosomiasis, and emphasis must be placed on rural sanitation, sewage treatment and the safeguarding of water supplies.

Repairing Bridge in Scranton

The job of repairing a 270-ft. bridge in Scranton, Pa., which is being handled by John H. Vockroth, consulting engineer of that city, will involve sand-blasting, guniting and black-top paving. The bridge is a 2-arch and retaining wall structure 48 ft. wide. Bids will be called for, probably in June.

Public Parking Stations Help Solve Traffic Problems

J. O. ARMSTRONG

City Engineer, Kansas City, Kans.

THE 1941 Legislature of Kansas, realizing the urgent need of off-street parking in cities of the first class, passed an act authorizing public parking stations, and prescribing the procedure for their establishment and improvement.

This act permits the governing body to acquire by purchase, gift or condemnation, lands for public parking stations in or near commercial or industrial districts. It provides that a benefit district be established by ordinance and that the cost of lands and improvement of lots be assessed not less than 75% nor more than 90% against property within the benefit district, with the balance of the cost assessed against the city at large.

Our downtown commercial area is located predominantly on Minnesota Avenue between Fourth Street and Twelfth Street. It is roughly an area eight blocks long and two blocks wide.

Locating the Stations

All but one of the six parking stations already constructed are located within one-half block of Minnesota Avenue and are adjacent to the commercial establishments fronting on Minnesota Avenue. Two are located between Fifth and Sixth Streets, one north with a capacity of 212 cars, and the other south with a capacity of 176 cars. One is located between Sixth and Seventh with a capacity of 152 cars, and two between Seventh and Eighth Streets, one north with a capacity of 73 cars and one south with a capacity of 72 cars. The sixth lot, with a capacity of 80 cars is located between Seventh and Eighth Streets immediately across the street from one of the other lots.

These lots are paved with concrete and provided with adequate storm sewers to carry off surface drainage rapidly. They are well lighted, and marked into stalls, 8 feet by 20 feet by concrete buttons. The parking limit between the hours of 8:00 a.m. and 6:00 p.m. is three hours and lots are patrolled at intervals by traffic squads.

In planning the parking stations, the "hollow block development" plan was used, thus preserving the corner

locations adjacent to stations as highly valuable business property.

Parking stations have a single vehicular entrance and exit and a minimum grade between the lot and the street. A number of pedestrian entrances are provided at points along the alley and the street. Each station is surrounded by a decorative masonry wall.

If and when it becomes necessary to provide additional parking facilities in the commercial district, a two-story surface can be constructed and safe entrances and exits provided by constructing ramps, taking advantage of existing street grades, which at each location favor such construction.

The total cost of the six parking stations above described was about \$429,260 or \$561 per car space. The cost of policing, operation and maintenance is negligible and has required no additional personnel.

Plans for three additional parking stations are on the drafting table at the present time. These are to be located in the area between Ninth

Street and Eleventh Street, each within one-half block of Minnesota Avenue. These stations will have a total capacity of 345 cars.

When the three new stations are completed early in 1949, there will be off-street parking space for a total of 1110 cars. On the basis of three-hour limit, they will provide a capacity of 3330 or more cars per day.

While our municipal public parking stations in the down-town commercial area do not solve all of our traffic problems, they have demonstrated that they reduce the volume of traffic in the business district. By providing near-by parking stations, it is possible to add to the convenience of shoppers and to retain the use of valuable curb spaces for short-time parking.

The City, to insure maximum use of curb space, has installed parking meters in the downtown business district. These include penny and nickel meters with a maximum of one-hour parking on the principal streets and two hours on the outlying streets.

Bathrooms and Piped Water in England

Numerous statements about the scarcity of bathrooms abroad as compared to the United States have appeared from time to time. Most have been very general and we have suspected were largely guess work; but on June 22nd last Charles Key, Minister of Works of England, stated that "There is no bathroom in 46 percent of the houses in this country, and no piped water supply in 44 per cent."

New Technique for Laying Macadam

In the course of twelve years spent in studying soil stabilization in Tunisia, a French engineer, J. L. Bonenfant, developed a new technique for laying macadam roads. Instead of a Telford foundation of large stone he used one or two layers of crusher run of stone between $\frac{1}{2}$ " and $2\frac{1}{2}$ ", rolled in layers 4" or less thick. He found that undulations, a frequent feature of macadam roads, were

almost completely avoided by rolling the material in successive homogeneous layers of pebble stone depth, provided the bottom layer has been carefully screeded and thoroughly compacted. The experiments are described in the magazine *Travaux*.

Incinerator Operation Costs

A breakdown of cost of operating the Lyttonville incinerator has been forwarded by Harry B. Shaw, deputy chief engineer of the Washington Suburban Sanitary District. In a recent letter to the Editor, the cost of disposal was reported as \$1.46 per ton. The items going into this total, per ton, are:

Labor	\$1.226
Depreciation	0.071
Repairs	0.060
Fuel oil	0.009
Cover material	0.012
Gas and oil	0.011
Power and light	0.064
Miscellaneous	0.008

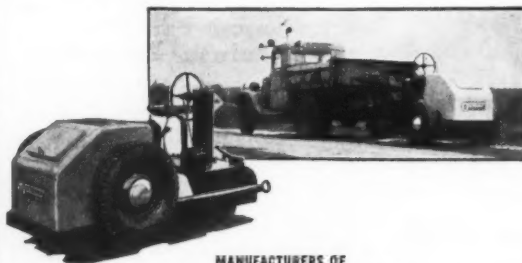
Total per ton \$1.461

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City-County

PUBLIC WORKS

Engineering Data

Average Bid Prices for Highway Construction

A tabulation of average bid prices on Federal-Aid projects for the third quarter of 1948 has been issued by the Public Roads Administration. Common excavation averaged 36¢ per yd., but varied in the 9 Divisions reporting from 30¢ to 79¢. Unclassified excavation averaged 46¢ and rock excavation \$1.48. Common dry structural excavation averaged \$3.97 per yd.

Bituminous surface treatments averaged 26¢ per sq. yd., but varied from \$1 down. Road mix surfaces averaged 54¢; bituminous intermediate surfaces 77¢; and bituminous concrete \$1.19. Portland cement concrete averaged \$3.57 per sq. yd.

Structural concrete in superstructures averaged \$49.74 per cu. yd.; in substructures \$45.76; and in foundations and footings, \$40.64.

Using Color to Reduce Accidents

An exhaustive study of the facilities, equipment, machines, operations and accident hazards in shops was made by the New York City Transit System in 1946. For this analysis, a standard color code for safety practices was developed. Yellow is employed for so-called strike-against, stumbling and falling hazards, such as projections, crane hooks, pit edges, etc. Orange is used to mark the dangerous parts of cutting and forming devices, exposed rails and wires. Blue is used to mark equipment down for repair. Green is for first aid cabinets, masks and stretchers. Red is reserved exclusively for fire protection.

Subgrades Damaged by Trees

Fast-growing trees, such as poplars and elms, are liable to cause damage to the foundations of roads where the subsoil is clay. Such trees remove water from the clay and cause shrinkage of the soil with consequent settlement of the road surface. Damage is also caused to buildings in the same way.

Recently a brief survey was carried out by the English Road Research Laboratory, to investigate the effect of fast-growing trees on roads. Surveyors and engineers of a number of county and local authorities assisted in the work. The main conclusions from the evidence were:

- (1) On heavy clay soils fast-growing trees may cause damage if they are planted within 50 ft. of the roadway, particularly during periods of very severe drought, such as occurred in the latter half of 1947. Small slow-growing trees within 10 ft. of the road or on the central reservations, and larger slow-growing trees planted further back are not likely to cause damage.

- (2) The effect of fast-growing trees in clay soils may be serious in urban areas where the trees are set in paved footways or where the rainfall distribution is affected by concentrated buildings.
- (3) No cases of damage to road foundations were observed in loam or sandy soils.
- (4) Poplars appeared to be the trees most likely to cause damage, but alder, elm, aspen and willow are also fast-growing and may cause damage.

The above is abstracted from a paper by D. Croney and W. A. Lewis, of the Road Research Laboratory before the Institution of Civil Engineers.

Radiant Heating for a Public Road

In the first application of radiant heating principles to a public road, the highway will be heated in cold weather by heat from a well reaching a hot water strata. The hot water will be circulated through a network of wrought iron pipe laid in the concrete. This section of road, which is 4-lane with an 8% grade, is 450 ft. long and passes under a railroad near Klamath Falls, Ore.

The well water has a temperature of 190°; its heat will be utilized by heat exchange methods. The design is based on melting one inch of snow or one-tenth of an inch of ice per hour.

Sanitary Fill for Hastings, Nebr.

A sanitary fill program for garbage disposal has been initiated by Hastings, Nebr., with the digging of a trench 400 ft. long, 14 ft. wide and 8 ft. deep. Of the 1659 cu. yds. of dirt excavated, 700 yds. were used for constructing a dumping ramp, which was then graveled. An International TD-14 tractor and 2-yd. Hough shovel completed the dirt-moving job in 45 hours.

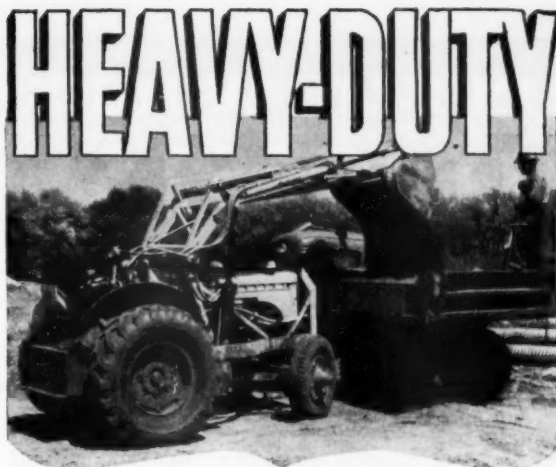
When the area has been filled, it will be topped with 2 ft. of soil, the upper 6 ins. being black soil, and then seeded.

Hourly Wage Rates Reported by PRA

For the fourth quarter of 1948, average wage rates are reported by the Public Roads Administration as follows: Unskilled, average \$1.08 per hr.; maximum, Pacific, \$1.59; minimum, East South Central, 77¢. Intermediate, average \$1.40; maximum, Pacific, \$1.77; minimum, South Atlantic, \$1.09. Skilled, average \$1.85; maximum, Pacific, \$2.23; minimum, South Atlantic, \$1.54. Executive, administrative and supervisory, average \$1.76; maximum, Mountain, \$2.08; minimum, East South Central, \$1.46.

Mosquito Control Operations in California

Reports from nineteen mosquito abatement organizations in California indicate that operations cover more than 11,500 sq. miles. In larviciding work, during the year ending June, 1948, 70 tons of DDT and 2 tons of TDE were used, with 27,000 gallons of oil. In addition to more than 10,000 cesspools, 43,000 catch basins and 30,000 miscellaneous containers, 477,000 acres of water surface were treated. In adult mosquito killing, 21 tons of DDT were applied. About 50 miles of ditches and drains and 60 miles of access roads were constructed.



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PUBLIC WORKS DIGESTS

Sewerage

Water Supply

Highways and Airports

This section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of all principal articles in these publications.

The Sewerage Digest

Biofilters vs. Standard Filters

The evidence obtained from a year's study of the chemical, biochemical, and biological characteristics of film at the different levels of the biofilter and the standard filter supports the view that the differences between the two filters are only quantitative, and pertain to rates rather than qualitative differences in the mechanism of purification. Both types of filters remove the materials from sewage by adsorption and "colloider" action.

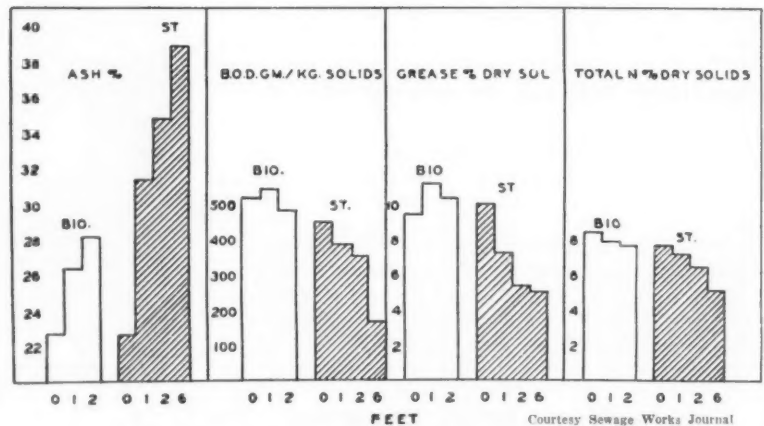
In both types of filters biological oxidation of the materials removed is of vital importance. The difference between the filters is in the relative magnitude of oxidation in each. As the load increases, the relative role played by adsorption as against oxidation increases. However, with an average loading of 1.4 lb. B.O.D. per cubic yard per day on the biofilter studied, biochemical oxidation plays an important part, as evidenced by an increase in ash, and a decrease in B.O.D., grease, and nitrogen with increasing depth and with higher temperatures during the summer.

The biofilter has an established nitrifying flora, although the filter may not produce an appreciable quantity of nitrites and nitrates. The protozoan fauna of the biofilter and that of the standard filter are similar, both quantitatively and qualitatively.

H. Heukelekian—"Similarities and Differences Between a Biofilter and a Standard Filter"; *Sewage Works Journal*, November.

Digestion of Cheese Whey

Marion, Ind., grinds its garbage and digests it with the sewage. During the past 3 yr. the secondary treatment units of the sewage plant have been seriously overloaded each spring by cheese whey from a milk processing plant. It has



Comparative data on biofilters and standard rate filters.

been found practicable to haul the whey to the plant in tank trucks and unload them directly into the garbage well and pump the mixture to the sludge digesters. In this way the whey does not reach the activated sludge units. The temperature of the whey is from 100° to 140° F, and so increases that of the garbage that even in winter the temperature of the mixture is 90° to 95°. Within 30 min. after pumping the garbage-whey mixture into the digester there is a sharp rise in the gas production rate. The dairy plant is charged \$1 for each 500 gal. of whey hauled from it.

David Backmeyer—"Disposal of Cheese Whey by Digestion"; *Sewage Works Journal*, November.

Wastes of Nuclear Fission Operations

The Atomic Energy Commission is studying the problem of protection of air, ground and water against contamination by wastes from nuclear fission operations. A waste disposal section of

A.E.C. has been set up in the Health Physics Div. of Oak Ridge National Laboratory. All radioactive substances go through progressive decay through the emission of energy. When waste waters are discharged into the soil, radioactive substances attach themselves to the soil and do not travel far. Coagulation and sedimentation remove some radioactive substances. Plankton in surface waters are known to absorb radioactive substances and to flourish, thus accumulating these materials within their bodies.

AEC is studying the development of closed systems which will retain all contaminated waters on-site, and is investigating the concentration of radioactivity by biological methods and the effect of varying amounts of such radioactivity on biological methods of sewage treatment. The institutional use of isotopes poses the question of the effect of institutional wastes on sewage treatment facilities.

Dry wastes may be buried in the ground, in a container. Glassware or

other utensils may become contaminated and must be buried. Incineration is inadvisable unless stack gases can be controlled. Air passed through a reactor may become contaminated and elaborate filter systems are required by AEC; studies are aimed at full air decontamination.

"Radioactive Wastes Disposal — A Problem of Tomorrow"; *Sewage Works Engineering*, December.

Dimensions of Septic Tanks

Septic tanks perform essentially three functions: Separation of settleable solids and of grease; digestion and storage of accumulated settleable solids and grease; and bio-septic treatment of the non-separating solids.

Within wide limits, the L:b ratio (ratio of length to width) of septic tanks of given volume and depth has little practical significance. In theory, longer tanks should result in more efficient performance; but in practice any ratio between about 2:1 and about 15:1 is believed to be satisfactory. Shallow depths in septic tanks should result in more efficient performance. There is believed to be little practical difference between a 30" depth and a 48" depth.

The really characteristic feature of the septic tank is the second of the three functions, during which significant change is produced in the nature of the retained materials and a significant reduction in the number of intestinal bacteria. The suspended solids are transformed from a gelatinous type particle difficult to separate from its surrounding water medium to a discrete granular type particle which is relatively easy to separate from its surrounding medium.

M. C. Nottingham and Harvey F. Ludwig — "Septic Tank Performance as Related to Tank Length, Width and Depth"; *Water & Sewage Works*, December.

Disposal of Digested Sludge By Dilution

The author describes an investigation made to evaluate the effect of returning digested sludge to primary effluent prior to disposal of the latter by dilution; the idea being to learn if, and under what conditions, it would be practicable to dispose of digested sludge by dilution rather than by the expensive methods now commonly employed. He concluded that such disposal is practicable whenever primary clarifier effluent can be so disposed of, providing only that sludge banks will not be formed. His conclusions are summarized as follows:

1. Under digestion conditions such as those existing at the Los Angeles County Sanitation Districts' joint disposal plant, addition of sewage solids that have been digested for 60 days (the first 11 days of which have been spent in the four-stage digestion tanks) to primary clarifier effluent [the latter by itself having an average 5-day (20° C) B.O.D. of 150 ppm.] will, on the average, change the characteristics

of the primary clarifier effluent in a manner similar to the following:

- (a) Increase the 5-day (20° C) B.O.D. by 3.2 ppm, or 2.1%;
- (b) Increase the settleable solids by 1.5 ml per liter;
- (c) Slightly decrease the coliform bacterial population;
- (d) Increase the grease content from 34 ppm to 41 ppm; and
- (e) Increase the chlorine demand from 36 ppm to 37.4 ppm, or 4.7%.

2. Substitution of 11-day-old sludge from the districts' four-stage digestion process for 60-day-old sludge will not so materially alter the foregoing conditions as to have any appreciable effect

on the characteristics of the mixed effluent and digested sludge.

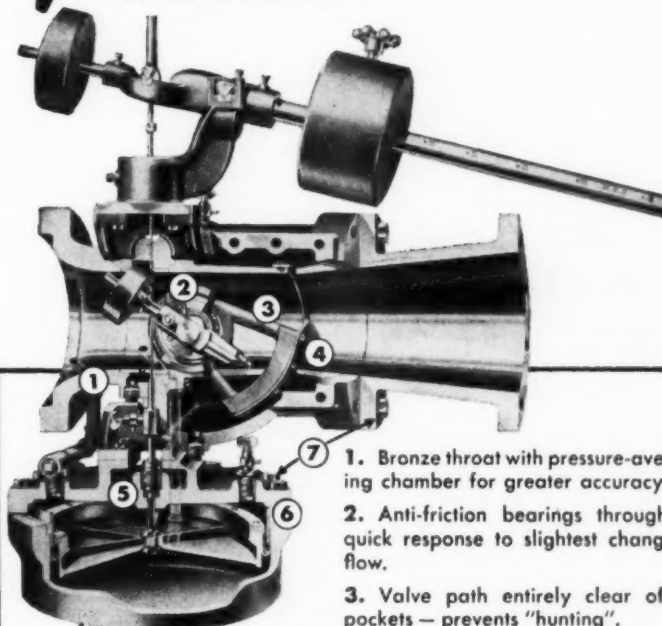
3. The increase in grease content is probably not of such an order as to influence the appearance of slick at an outfall site.

4. In general, the influence of adding 11-day-old or 60-day-old sludge to primary clarifier effluent is probably less than daily variations in the character of the effluent itself.

5. Wherever sludge banks will not be formed, there appears to be no valid reason why 11-day-old, or 60-day-old, digested sewage sludge may not be disposed of by dilution along with primary clarifier effluent if conditions per-

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mit disposal of the latter with safety.

A. M. Rawn and E. J. Candel—"Some Effects of Anaerobic Digestion on Sewage Sludge"; *Proceedings, Am. Soc. of Civil Engineers*, November.

Treatment of Industrial Effluents

In a paper before the English Public Health and Municipal Engineering Congress, Dr. B. A. Southgate, Director of Water Pollution Research, Dept. of Science and Industrial Research, reviewed recent developments in the treatment of industrial effluents, including the results of experiments by his department and reference to both English and American experiences. A brief summary of parts of his paper are given below.

Frequently the cheapest way of dealing with the problem of industrial waste water is to make changes in the processes. In Great Britain, partial treatment so often practicable in America is not sufficient.

Milk wastes are usually very alkaline and difficult to treat biologically; but alteration in the processes of manufacture would reduce the quantity of alkali lost in the waste system, and there is a very fair prospect that this can be done. Biological treatment of milk wastes by alternating double filtration is found generally satisfactory at a number of dairies. As for cannery wastes, the American practice of screening, sedimentation, lagooning after adding alkali and sodium nitrate, and spraying over land is impracticable in many British factories, but they have been treated successfully by both activated sludge and biological filtration. However, they are deficient in nitrogen and addition of an ammonium salt and phosphate is necessary for satisfactory results.

Some liquors from the manufacture of synthetic resins contain high concentrations of phenols and other substances and could not be treated economically by biological methods; it seems probable that recovery of the constituents in a useful form will prove to be a more economical process. It is often impossible to reduce substantially the total volume of spent liquor from gas works, but it is possible to change the process of manufacture so as to alter the composition of the liquor, though not to reduce greatly its total oxygen demand. It is recommended that only spent gas liquor should be discharged to sewage, the ammonia being recovered at the gas works; and that content of higher tar acids and thiocyanate should be reduced as far as possible by modifying the process at the gas works; and the liquor discharged to a sewage at as uniform a rate as possible. Birmingham has treated spent gas liquor by using an electrostatic tar precipitator, admitting air to the gas just before the purifiers instead of at the exhausters, recovering the ammonia as concentrated ammonia liquor, and admitting the final waste waters to the sewers at a controlled rate, which has

removed all difficulty at the sewage works.

The best method of treating spent copper pickling liquor is by electrolysis, either in the pickling vat itself or in a central plant to which the liquor from the vats is pumped continuously; the metallic copper is deposited on the cathodes in a state in which it can be used directly. Treatment with iron is considered in Germany to be the most efficient method.

A most promising method of attacking the steel pickle problem is to recover crystalline ferrous sulphate from the pickle liquor, preferably by a continuous process, which reduces losses of sulphuric acid and enables the process of pickling to be carried on under constant favorable conditions. A satisfactory method probably will be developed in which the ferrous compounds are oxidized under controlled conditions and the acid is neutralized by passage through limestone.

Cyanide (as in waste liquids from electroplating) is extremely toxic to fish and 1 ppm interferes with the activated sludge process. It is oxidized in a filter by bacterial action, but any marked fluctuation in rate of application causes deterioration in quality of filter effluent.

It is usually impossible to separate oil from aqueous emulsions of oils from machine shops by flotation without breaking the emulsion by adding a metallic salt. In one case the liquid, which is alkaline, was reduced to pH 7 with sulphuric acid and a solution of aluminum sulphate added and stirred by compressed air; and after standing for 4 hours the grease was skimmed off.

B. A. Southgate—"Recent Developments in the Treatment of Industrial Effluents"; *Contractors Record*, Nov. 17.

Air Diffusion for Activated Sludge

In New York City's activated sludge plants, air under a pressure of 6.5 lb. or more is diffused through porous plates. Since 1939 extensive studies have been made of the tendencies to clogging of the diffusers—the location and nature of the clogging matter, and methods of preventing or remedying it. Clogging was found to be both internal, caused by impurities carried by the air stream; and external, caused by penetration of foreign matter from the aeration tank liquor into the interstices. Air diffusion involves many factors, such as quality of raw air; air filters; coating of mains, laterals and valves; diffuser holders; the diffuser media; care and maintenance of equipment, and operation of aerators in service and out of service.

For filtering relatively clean air, oil screens followed by cellulose treated mats seem adequate, but smoky or sooty air may require more thorough cleaning, such as electrostatic units. The bonding material used in manufacturing diffuser plates does not always fuse to the grains, and loose particles of it migrate through the plate to the wetted zone on the water side, causing uneven

air distribution. Surface grains should have a smooth surface, so fibers will not be attacked.

Greater porosity is not the answer to diffuser problems. The emitted bubbles are quite large even at a permeability of 40. A less permeable plate of say 15 or less would provide ample air flow per unit area at conventional rates. However, higher rates of air flow per square foot are desirable to prevent migration of aeration tank solids into the plate. An air rate of 3 to 10 cfm. per square foot is not excessive for diffusers having a permeability of 35 or more. A somewhat less rate of 2 to 5 may be desirable for diffusers having a permeability of 15 to 20.

In order to secure wide band aeration without the excessive use of air for these high rates of air flow per square foot, the plates should be manufactured so that they may be installed in rows only 3 to 6 inches wide. Two to four rows spaced the width of the narrow plates in an aerator 20 to 30 feet wide should be controlled by separate valves so the air demand can be met by adding air to a row normally held in reserve.

The diffuser plates should be grouted into the holders or otherwise installed such that the entire external side is wetted or sealed.

Biological clogging caused by stalked ciliates, aquatic worms and filamentous organisms becomes more severe the higher the B.O.D. loading and the less the permeability of the plates. Means should be sought to discourage organisms from using the media as an abode by the continuous or intermittent injection of a mild disinfectant into the air stream.

Lloyd R. Setter—"Air Diffusion Problems at Activated Sludge Plants." *Water and Sewage Works*, December.

Effect of Alkali-Chlorination Of Wastes on Sewage Treatment

Recently alkali-chlorination of metal plating wastes for removing the cyanides and heavy metals has come into use, and it is important to know the effect of wastes so treated on biological treatment of sewage into which they are discharged. Laboratory studies have indicated that they are toxic in high concentrations, but the efficiency of the sewage treatment is not seriously impaired unless the concentrations are quite high; 16,000 lb. of treated waste per million gallons of sewage could be tolerated by an aerobic treatment plant if discharged into the sewer at a uniform rate over a 24 hr. period. Digestion units would be even less affected. Proper settling of the treated metal plating wastes before discharge into the sewer would make such disposal of them even less deleterious.

G. M. Ridenour—"Laboratory Studies on Effect of Alkali-Chlorinated Cyanide Case Hardening, Copper and Zinc Plating Wastes on Aerobic and Anaerobic Sewage Treatment Processes"; *Sewage Works Journal*, November.

Sewage Lagooning

In Texas and southern California, reliable year-round operation of lagoons is obtained with a loading of 40 lb. of BOD per acre per day. Algae are effective biological agents by virtue of their oxygen production in photosynthesis. The species of algae differ in different lagoons and from time to time in the same lagoon. In the daytime the oxygen concentration decreases rapidly with depth. There is a tendency for DO, pH and temperature at all depths above 3 ft. to equalize at night. The algae may produce during the daytime 10 to 20 times as much oxygen as they will use during the night, which oxygen is used in the microbial decomposition of organic matter.

Photosynthesis is a process in which oxygen is excreted from the cells but almost all of the organic material converted into cellular materials. The oxygen production decreases with the depth. Photosynthesis is relatively independent of temperature but the overall metabolism and growth of the algae are markedly affected by temperature. CO_2 is taken up by the algae principally as free CO_2 or H_2CO_3 , and is available adequately at pH values up to about 9. Algae may produce oxygen concentrations up to 39.2 ppm. at 25°C during the day. In all lagoons there is a bottom layer of sludge which gives off gas bubbles.

Treatment favored by present information includes primary settling, use of several lagoons in series, with depths of 3 to 6 ft., and daily loadings of about 40 lb. of BOD per acre for the total lagoon system. Lagoons are more dependent on weather conditions and less consistent in operation than conventional sewage plants. Their essential merit lies in the low construction and maintenance costs.

Jack Myers—"Studies of Sewage Lagoons"; PUBLIC WORKS, December.

Oxidation Ponds

Sewage oxidation ponds should not be located where the soil is loose or sandy. They should be at least 3 or 4 ft. deep, not over 10 ft. Loadings vary from 10 to 50 lb. of B.O.D. per acre-foot per day. The B.O.D. is reduced about 50%. Coliform bacteria may be reduced from 100,000 to 50 per m.l. Overloading may produce odors. Cleaning may be necessary every 6 to 8 yr. Banks should be kept free of weeds, thus preventing mosquito breeding. The effluents are permanently stable, with B.O.D. values at least as good as those from trickling filters. They are almost unbelievably effective in destroying sewage bacteria. They require much sunlight, light rainfall, and relatively high temperature. Their chief value is in oxidation, thus differing from lagooning, which is chiefly used for sedimentation, storage or digestion of industrial wastes or sludge.

Report of Committee of A.P.H.A.; *Sewage Works Journal*, November.

BIBLIOGRAPHY

American City

Kitchen Grinders to Influence Refuse-Disposal Practices. December, Pp. 88-90.
Milwaukee's Special-Section Sewer. December, P. 99.

Am. Soc. of Civil Engineers Proceedings

Some Effects of Anaerobic Digestion on Sewage Sludge. By A. M. Rawn, Chf. Engr., and E. J. Candel, Sewage Plant Chemist, Los Angeles County Sanitation Dist. November, Pp. 1467-1479.

Contractors Record (England)

Recent Developments in the Treatment of Industrial Effluents. By B. A. Southgate,

Director, Dept. of Sci. & Indus. Research. Nov. 17, Pp. 19-24.

Engineering News-Record

Sanitary-Sewer Design Formulas. By Benjamin Eisner, John F. Laboon, John W. Cunningham, I. Russell Riker, and Thomas R. Camp. Nov. 25, Pp. 76-78.
Rubbish Incinerator in Residential City Satisfies Rigid Requirements. By Linne C. Larson, Consult. Engr. Dec. 9, Pp. 104-107.

Public Works

Studies of Sewage Lagoons. By Jack Myers, Texas State Dept. of Health. December, Pp. 25-27.
Central Treatment vs. Several Small Plants. December, Pp. 38, 51.
Sewerage Plans for the Nashville Urban Area. December, Pp. 39-41.
Fly Control at Newark's Refuse Disposal Areas. By John H. Austin, Engr. Dept. of Parks & Pub. Property. December, Pp. 44-45.

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Modernized Sewer Maintenance. By D. H. Hurst, City Engr., Tifton, Ga. December, Pp. 50-51.

Sewage Works Engineering

Lime Treatment of Cranberry Packing Wastes. By Robert P. Logan and R. Y. LeVine, N. J. Agri. Experiment Sta. December, Pp. 635-637.
Sewage and Wastes Treatment in Great Lakes Area. December, Pp. 638-649.

Sewage Works Journal

Sludge Digestion Experiences With the External Heat Exchanger. By Walter M. Kunsch, Manager Urbana-Champaign San. Dist. November, Pp. 969-1007.
A Statistical Approach to Sewage Chlorination. By Rolf Eliassen, Austin N. Heller and Herman L. Krieger, Prof. of San. Eng., Research Assoc. and Research Asst., New York Univ. November, Pp. 1008-1024.
Oxidation Ponds. Report of Committee of A.P.H.A., Langdon Pearse, Chairman, November, Pp. 1025-1031.

Similarities and Differences Between a Biofilter and a Standard Filter. By H. Heukelekian, Assoc. Dept. of Water & Sewage Research, Rutgers Univ. November, Pp. 1032-1040.

The Polarographic Determination of Dissolved Oxygen in Water and Sewage. By Ed. W. Moore, J. Carrelli Morris and Daniel A. Okun, Assoc. Prof., Asst. Prof. & Fellow, Harvard School of Eng. November, Pp. 1041-1053.

The "Wide Band" Air Diffusion System. By Frank C. Roe, Mgr. Chicago Pump Co. November, Pp. 1054-1058.

Laboratory Studies on Effect of Alkali-Chlorinated Cyanide, Case Hardening, Copper and Zinc Plating Wastes on Aerobic and Anaerobic Sewage Treatment Processes. By G. M. Ridenour, Assoc. Prof. of Public Health, Univ. of Mich. November, Pp. 1059-1073.

The Toxicity to Warm-Water Fishes of Certain Cyanide Plating and Carburizing Salts Before and After Treatment by the Alkali-Chlorination Method. By Geo. N.

Washburn, Mich. Dept. of Conservation. November, Pp. 1074-1083.

Compressed Yeast Waste Treatment. By Willem Rudolfs and Eugene H. Trubnick, Rutgers Univ. November, Pp. 1084-1090.

Central States Sewage Works Operators Breakfast Forum. November, Pp. 1092-1106.

Disposal of Cheese Whey by Digestion. By David Backmeyer, Supt. Water & Sew. Treat., Marion, Ind. November, Pp. 1115-1118.

Cleaning a Sewer Clogged by Industrial Waste. By Geo. W. Olson, City Eng., Woburn, Mass. November, Pp. 1119-1122.

Gas Line Clogged by Corrosion Deposit. By Wm. L. Edwards, sewer plant operator, Helmhuth, N. Y. November, Pp. 1122-1123.

The Surveyor (England)

Periodicity of Dosing Percolating Filters. Discussion of paper by C. Lumb and J. P. Barnes. (Sewerage Digest for October.) Oct. 29, Pp. 567-568.

Water and Sewage Works

Air Diffusion Problems at Activated Sludge Plants. By Lloyd R. Setter, San. Engr., Tenn. Valley Authority. December, Pp. 450-456.

Digestion of Sewage Solids: Lagoons and Lagooning. By Leroy W. Van Kleeck, Conn. State Dept. of Health. December, Pp. 457-459.

Septic Tank Performance as Related to Tank Length, Width and Depth. By M. C. Nottingham, Pres. M. C. Nottingham Co., and Harvey F. Ludwig, Cons. Engr. December, Pp. 460-464.

Sewage and Industrial Waste Treatment in New Jersey

According to the estimate of the State Department of Health as of June 30, 1947, 86.8% of the population of New Jersey were served by sewer systems; and 75.5% of these were provided with sewage treatment plants. The sewered population was included in 265 municipalities, of which 203 were under jurisdiction of the State Department of Health, 29 were in the Passaic Valley Sewerage District, and 33 were in the Interstate Sanitation District. All of the sewered population in the Passaic Valley were served by treatment plants; 87.8% of the sewered population under the State Department of Health was also so served, and 75.1% of the remainder were under orders to install sewage treatment. In the Interstate Sanitation District, 32.8% of the sewered population were provided with treatment plants and 41.0% of the remainder were under orders to install plants.

It was estimated that the total volume of industrial wastes discharged into the waters of the state amounted to 283 million gallons per day. Of this amount, 138 mgd were treated partly or completely. Orders had been issued, or hearings were being held, for treating the remaining 145 mgd of industrial waste.

Since the population of the state amounts to about 4,160,000, industrial waste averages nearly 70 gallons per person per day. This is probably approximately equal to the sewage discharge.

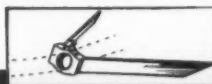
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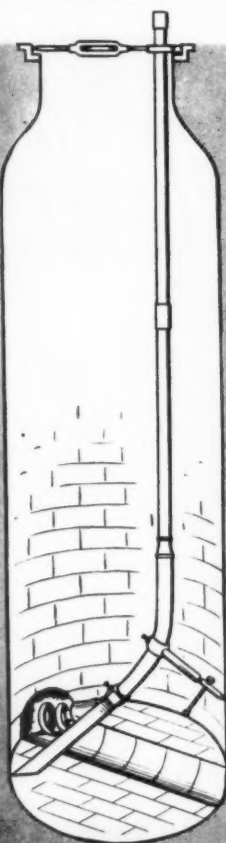
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Winter Maintenance Of Tractors

Suggestions made by Allis-Chalmers for winterization of tractors, considerably condensed, are as follows: Use a permanent, ethylene glycol anti-freeze solution, 3 parts to 2 parts water, in the cooling system; then the engine can be kept at normal 160° to 185° without loss of solution. Test it periodically to make sure it is strong enough. Be sure the thermostat is in good order and keeps the engine operating temperature at 160° to 185°. Have either a shutter or curtain for the radiator.

When changing oil at 32° or below, use the S.A.E. number recommended in the manufacturer's service manual. For fuel, be sure the pour point is low enough to permit it to flow freely under prevailing operating temperature. For cold weather, lighter fuels such as No. 1 Diesel have a lower pour point and the cetane number is higher along with a low distillation end point, which determine easy starting and clean burning. Keep the fuel clean and drain the sediment sumps under the fuel tank every night.

Batteries must be kept in good condition to prevent freezing. Keep the top clean; electrolyte should cover the cell plates. Check battery reading at frequent intervals; at 32° or below, the specific gravity should not go below 1.25.

Prolonged idling of the engine during cold weather causes dilution of lubricating oil, and lacquer or tar-like deposits on valves, pistons and cylinder liners, which cause abnormal engine wear and poor performance.

Clean the mud and snow out of the tracks and truck wheels and from the support rollers before leaving the tractor at night. Then park it on solid ground to prevent it from freezing down. A lot of dirt and snow will fall off if it is run back and forth a few times in a cleared solid place.

"Tips on Tractor Winterization"; *The Constructor*, November.

Snow Fences In Pennsylvania

Pennsylvania state laws permit the Dept. of Highways to erect and maintain snow fence on private property between Nov. 1 and March 31, and it erects and removes 26,000,000 ft. annually, at locations where drifting is liable to occur on the 40,893 miles of the state system. Trucks and tractors are overhauled as soon as they can be released from construction work, and about Dec. 1, snow plow attachments are installed. The department uses 1,362



Courtesy Allis-Chalmers

Taking care of tractors.

department-owned trucks and 500 rented ones, all equipped with plows, and 161 power graders and 70 tractors equipped with V-plows or bulldozers. In case of an ice storm, 500 trucks and 1200 wagonettes are used to spread cinders; for which, mechanical spreaders gave excellent results where screened cinders were used. In the Pittsburgh and Philadelphia area, sodium chloride was used on bituminous pavements, and on concrete ones more than 5 yr. old, at the rate of 400 lb. per mile of 2-lane pavement. This was applied after the snow had been removed, to remove any ice film and give a bare pavement. Some 20,398 miles of state roads are scheduled for complete snow removal; after these have been plowed, attention is paid to improved secondary roads.

Warren K. Myers—\$7,000,000 Snow Fleet Keeps Pennsylvania's State Roads Open"; *Roads & Streets*, November.

Salting Streets In New York City

There are 2400 miles of streets in New York City to be salted in case of snow. When the weather bureau notifies the department that a snow storm is coming, the 60 garage foremen are notified to make sure that the several thousand pieces of equipment are ready for action and the 10,000 men available. When the rain reaches 1" depth the rock salt spreaders go out, covering bus routes and main thoroughfares first. For anything up to a 4" fall and for freezing rains, rock salt is relied on and ordinarily no plowing is done. If the depth increases, plows can clean right down to the pavement. An enormous amount of salt is used, and deliveries in boxcars are begun in October, and stored at 54 indoor storage points—43 garages, 7 incinerators and other buildings. When the salt is to be used it is

loaded into spreaders with old snow loading machines.

Wm. J. Powell—"Rock Salt Storage in New York"; *PUBLIC WORKS*, December.

Effect of Frost on Roads

For many years Minnesota has required axle loads to be reduced to as low as 3 tons during the spring when the subgrades may be softened by thawing. There has been considerable criticism of this practice by the 5% of the road users whom it affects, and the highway department has been seeking scientific data to support the restrictions. A truck and trailer are so arranged that loads up to 30,000 lbs. can be applied to a 12" diam. bearing plate by means of a hydraulic jack. Tests are made at intervals throughout the year at selected points with a variety of soils and bases. Loads are applied on top of the pavement, on the granular base, or on the subgrade soil. Deflections under the applied loads are measured by a deflection beam. On practically all soils tested to date the safe load-bearing capacity is reached at a deflection of 0.3" in the black-top pavement. Results indicate that when frost is coming out of the ground, most types of soil lose more than 50% of their load-carrying capacity.

"Effect of Frost on Roads Studied in Minnesota"; *Engineering News-Record*, Dec. 9.

Immersion-Compression Test of Adhesion of Bitumens

Loss of adhesion of bituminous film to the surface of mineral aggregate through the action of moisture, and the resultant stripping, is often a major cause of failure in bituminous pavements. The immersion-compression test was developed to provide a means of determining the resistance of bituminous mixtures to the detrimental action of moisture. This method has definite advantages over the various stripping tests now in use. It provides a quantitative index of the damage caused by moisture, and the test is made on the entire mixture as it might be prepared for use in the road rather than on the single-size fractions of aggregate that are used in stripping tests.

The immersion-compression test involves a comparison of the compressive strengths of molded cylindrical specimens of bituminous mixtures with the strengths of duplicate specimens that have undergone immersion in water for a definite period of time. The test gages the tendency of a mixture to strip by

measuring the reduction in strength of the specimens caused by the loss in adhesion of the bituminous film to the aggregate particles.

Changes have been made in the procedure of this test, and this article describes in detail one which is now believed to be satisfactory.

The article also describes results of studies on combinations of various asphalts, aggregates and additives, using this test. These showed that there is a wide range in the film-retention properties of aggregates, Limestone, in general, has high resistance to the stripping action of water, but this varies considerably with limestone from different sources. Trap rock has high film-retention properties; granites range from good to bad, and quartzite was the least satisfactory aggregate studied. In some cases the quality of the sand and filler used was found to be more important than that of the coarse aggregate; silica dust was much less satisfactory than limestone dust.

Tests were made using three different additives. All were very effective with a granite aggregate, and two of them with gravel. The beneficial effects, when used with medium-curing cut-back asphalt, appeared to be fairly permanent. Many stripping failures are due to the inferior adhesive qualities of the asphalt itself. Asphalts of the same grade from different sources may vary widely in their resistance to the action of moisture.

J. T. Pauls and J. F. Goode—"Further Developments and Application of the Immersion-Compression Test"; *Public Roads*, December.

Construction of Public Works by Contract

The advantages to the public of the construction of public works by the contract method can be summarized as follows:

1. Guaranteed cost of the project known before construction starts.
2. Guaranteed quality in accordance with plans and specifications.
3. Completion on schedule.
4. Lowest possible cost secured through free and open competition.
5. A project planned to fit the needs most effectively.
6. Centralized responsibility for the construction.

7. Construction through the normal channels of the construction industry.

Since 1937, no construction for the U. S. Bureau of Reclamation has been done by force account or on a hired-labor basis except for management and operation, maintenance and repairs, engineering and supervision, routine minor construction work, or in case of emergencies, local in character, so declared by the Commissioner of the Bureau of Reclamation and the Interior Dept. appropriation act for the year 1947-1948 includes the statement: "Evidence before the committee indicates that the new policy has worked out well . . . the committee sees no reason to make a change of any consequence so has

substituted the same language as last year except for two minor changes."

"The Contract Method of Construction Safeguards Public Funds"; *The Constructor*, November.

Contracting Road Maintenance

PRA has reported that 30 states did part of their 1947 road maintenance by contract; over 1/3 or them did more than 15% in this way. South Carolina did 34%, North Dakota 30%, New Hampshire 26%. North Carolina contracted both low-type and high-type bituminous resurfacing, crushing and stockpiling aggregate, placing it on the road surface, and hauling it from R. R. sidings to the jobs; the entire contract cost totaling \$8,000,000. Ohio contracted bituminous surface treatment, bridge painting, guard rail painting, construction and reconstruction. Bridge painting, which includes sand blasting, spot painting, prime coating and full coat, was awarded in Ohio for 266 bridges in 1948. At least 12 other states contract the painting of their major bridges. South Carolina let over 70% of its 1947 bituminous retread program, and this year awarded the major portion of its resurfacing work on both low-type and high-type bituminous pavements. Many cities are contracting increasing proportions of their maintenance work.

Numerous advantages other than a major cost saving are listed by those states and local organizations awarding maintenance operations. These include:

- (1) During a period when some types of equipment are difficult to secure, work can be carried out without delay and without making large investments in machinery for which there may be only part time use.
- (2) Regular maintenance forces are released for other work and the necessity of hiring additional men on a temporary basis during the summer months when labor is hard to secure is avoided.
- (3) Engineers and technical help are freed for new construction operations, which is extremely important during this period when state highway departments are short-handed.
- (4) The regular maintenance forces are freed for work that does not lend itself to contract performance.

A. N. Carter—"Contracting Cuts Road Maintenance Costs"; *Eng. News-Record*, Nov. 25.

Today's Largest Airfield Construction

The largest job of airfield construction now going on is that of the Limestone Air Force Base in Maine. The principal features include a 2-mile runway, a 2,000-ft. by 400-ft. parking apron, an operations building, hangar, barracks, water system and railroad spur; 960 acres of clearing, 390 acres of grubbing, over 2,000,000 cu. yd. of excavation and 1,250,000 cu. yd. of fill compaction. Last winter temperatures fell to 45° below zero and remained

below zero continuously for a whole month. Tractor motors had to be started up for warming every two hours all night. The many swampy spots were drained last fall so as not to delay starting excavation in early spring. Pavement areas were stripped of unsatisfactory soil and the top 6" compacted to 100% modified ASSHO density with sheepsfoot rollers, 42" to 60" diameter. Layers of fill were similarly compacted. Euclid bottom-dump wagons loaded by two Euclid loaders averaged 16,000 cu. yd. a day. Tractor-drawn and self-powered scrapers brought the total to 22,000 cu. yd. with a peak of 35,000. Truck shovels were used in pockets and around outcroppings. The base was of gravel compacted to 95% and two top stone layers to 100% as determined by the Providence method. Gravel was compacted by Porter 200-ton rollers with 4 pneumatic tires followed by a 123-ton 6-tired roller. In spreading the gravel, 5-ton and 8-ton trucks came in a continuous procession so that at any given moment two to five were dumping. Hot-mix surface is to be prepared with a Hetherington & Berner and an assembled plant to turn out 70 tons per hr., and spread with 2 Barber-Greene pavers. The force employed consists of about 1500 men, 9 superintendents, 11 assistants and nearly 100 foremen.

Harold J. McKeever—"New Criteria Bomber Base for the B-36's"; *Roads and Streets*, November.

Placing Sod By Conveyor

In sodding large cut and fill slopes, a Michigan road contractor in 1948 used a 40 ft. belt conveyor for placing the sod. The conveyor can be placed in any position at any angle up or down a slope. It was driven by a small gasoline motor. Sod was placed at the rate of 2,000 sq. yd. a day with a 5-man crew including the truck driver.

"Placing Sod by Conveyor"; *Roads & Streets*, November.

BIBLIOGRAPHY

American City

Bay City Uses Paver for Curb and Gutter. By R. K. McGilivray, Dir. of Pub. Wks. December, Pp. 112-113.

Am. Soc. of Civil Engineers Proceedings The Municipal Asphalt Plant, Borough of Manhattan. By L. Czanyi, with Edwards & Kelsey, Cons. Engrs. November, Pp. 1433-1457.

Am. Soc. for Testing Materials: "Symposium on Mineral Aggregates"

Distribution of Mineral Aggregates. By K. B. Woods, Prof. of H'way Eng., Purdue Univ. Pp. 4-19.

Petrographic and Mineralogical Characteristics of Aggregates. By Roger Rhoades and Richard C. Mielenz, Chief Geologist and head of Petrographic Laboratory, Bureau of Reclamation. Pp. 20-48.

Physical and Chemical Tests of Mineral Aggregates and Their Significance. By Harold W. Sweet, Research Eng., Purdue Univ. Pp. 49-73.

Sampling of Mineral Aggregates. By C. E. Proudley, Eng'g. N. C. State H'way Comm. Pp. 74-87.

Production and Manufacture of Fine and Coarse Aggregates. By Nathan C. Rockwood, "Rock Products." Pp. 88-116.

Grading Aggregates for Bituminous Construction. By Jewell R. Benson, Bit. Eng'r.

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U. S. Bureau of Reclamation. Pp. 117-133.
Grading Mineral Aggregates for Portland Cement Concrete and Mortars. By Walter H. Price, Engr. Bureau of Reclamation. Pp. 134-151.
Influence of Mineral Aggregates on the Strength and Durability of Concrete. By Chas. W. Allen, Engr. Ohio H'way Dept. Pp. 152-159.
Mineral Aggregates for Bituminous Construction. By J. T. Pauls and C. A. Carpenter, Engrs., P.R.A. Pp. 173-182.
Mineral Aggregates for Low-Cost Roads and Waterbound Macadams. By E. A. Willis and J. A. Kelley, Jr., Engrs., P.R.A. Pp. 183-195.

Better Roads

Flood Control Cuts Road Upkeep. By H. N. Smith, U. S. Soil Conservation Service. November, Pp. 27-28.
Airphotos—Tool of Multiple Uses. By Phillip L. Melville, Virginia H'way Dept. November, Pp. 33-35.
Organization for State Right-of-Way Work. By Frank C. Balfour, Calif. Div. of Highways. November, Pp. 40, 42.

Civil Engineering

Comprehensive Traffic Studies Determine Choice of Parkway Route. By E. L. Schmidt, Chf. Engr. Penn. Dept. of Highways. December, Pp. 36-38.
Downtown Interchange Will Carry Traffic Through Congested Pittsburgh Triangle. By Geo. S. Richardson, consult. engr. December, Pp. 38-40.
Twin Two-Lane Tubes Carry 4,225 Ft. Length of Parkway Under Squirrel Hill. By Ole Singstad, consult. engr. December, Pp. 40-43.
Careful Scheduling of Operations Expedites Construction of Railroad Underpass. By S. L. Fuller, Pres. John F. Casey Co. December, Pp. 43-46.

Engineering News-Record

Contracting Cuts Road Maintenance Costs. By A. N. Carter, Manager H'way Contractors' Div., A.G.C.A. Nov. 25, Pp. 67-71.
Effect of Frost on Roads Studied in Minnesota. Dec. 9, Pp. 88.
Little Road Maintenance in Wyoming Done by Contract Methods. By Wm. E.

Sutton, Maint. & Equip. Engr. Wyoming H'way Dept. Dec. 9, Pp. 102-103.

The Constructor

The Contract Method of Construction Safeguards Public Funds. November, Pp. 45-47.
Tips on Tractor Winterization. November, P. 68.

Contractors Record (England)

The Mechanization of Municipal and Highway Engineering Works and Its Economics. By E. F. B. Dykes. Nov. 24, Pp. 19-23.

Public Roads

Further Developments and Application of the Immersion-Compression Test. By J. T. Pauls, Prin. H'way Engr., and J. F. Goode, H'way Research Engr., P.R.A. December, Pp. 109-117.
A Rapid Method of Testing Materials for Alkali-Aggregate Reaction. By D. O. Woolf, Sr. Materials Engr., and T. R. Smith, Sr. Scientific Aid, P.R.A. December, Pp. 118-120.
Conducting Long-Range Highway Needs Studies. By Fred B. Farrell, Chf. H'way Cost Sect. P.R.A. December, Pp. 121-128.

Public Works

Problems in Bridge Building. By C. Arthur Elliott, County Engr., Greene Co., Ia. December, Pp. 23-24.
County Engineers Tell What Is Their Most Useful Equipment. December, Pp. 31-34.
Rock Salt Storage in New York. By Wm. J. Powell, Com'r., Dept. of Sanitation. December, P. 48.

Roads and Bridges

Quebec's \$20,000,000 Talbot Highway. October, Pp. 49-54, 59.
Elimination of Protection of Railway-Highway Level Crossings. By D. G. Kilburn, Dir. of Eng. Transport Com'r's for Canada. October, Pp. 55-57, 92.
Highway Mobile Telephone Service. By S. Bonnevillie and D. J. McDonald, Engrs. Bell Telephone Co. October, Pp. 59-60, 109.

Vermont's Experience With Snow Removal and Ice Control. By Hubert E. Sargent, Com'r of H'ways. October, Pp. 61, 94.
Survey of Practice in Controlling Pumping of Concrete Pavement Slabs. October, Pp. 62-63, 104.
Highway Work Hampered by Low Salaries of Engineers. By James L. Wickwire, Engr. Nova Scotia Dept. of H'ways. November, Pp. 57-59, 100.
Design of Access Connections to Main Highways. November, Pp. 71-72, 98.

Roads and Streets

Sheepsfoot Rollers: Compaction Controversy. By D. K. Heiple, of R. G. LeTourneau. November, Pp. 52-53.
"New Criteria" Bomber Base for the B-36's. November, Pp. 54-61.
\$7,000,000 Snow Fleet Keeps Pennsylvania's State Roads Open. By Warren K. Myers, Maint. Engr., Penn. Dept. of Highways. November, Pp. 83-85.

The Surveyor (England)

Efficiency of Highway Plant and Haulage Measured in Relation to Service. By Thomas Vickers. Oct. 29, Pp. 569-570.
Road Maintenance in Scottish Highland Counties. By James Irvine, District Surveyor. Nov. 5, P. 591.
Raising of Concrete Road Slabs by Pressure Grouting. By C. K. Tallack, Lindsey Co. Surveyor. Nov. 12, P. 595.
Concrete Road Construction by Mechanical Equipment. By E. J. Powell, Nov. 19, Pp. 611-613.
Developments and Trends in Bituminous Road Surfaces. By R. Slater, Fed. of Coated Macadam Industries. Nov. 26, Pp. 629-630.

Chesapeake Bay Bridge

J. E. Greiner Co., Baltimore, Md., are consultants on the proposed Chesapeake Bay bridge near Sandy Point and Annapolis, Md. This bridge will be 22,000 feet long and the estimated cost is \$34,000,000.

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Russian Highway Signs

The illustration herewith shows the road signs that have been adopted by the Russian government to replace the old 1937 standards. The warning signs are placed 120 to 180 meters ahead of the danger spot on ordinary roads, and 250 meters on a motor traffic highway. A driver disregarding these is held responsible "in administrative or legal form, depending on the consequences that such infringement caused or might have caused." However, if it is shown that the sign was placed too near to, or distant from, the danger spot, the responsibility is placed on those responsible for such misplacement.

The signs have a bright yellow background with black lettering, and a red border on the warning signs, a black border on the others. The sides of triangles and of squares and diameters of circles are each 700 mm. On roads of Classes I, II and III, warning signs are always equipped with light reflectors, 3 in each angle of the triangle.

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WARNING SIGNS



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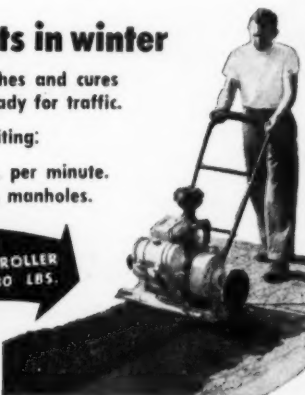
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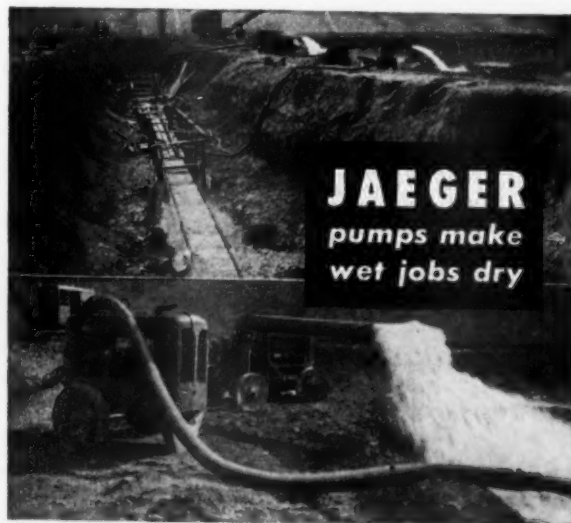


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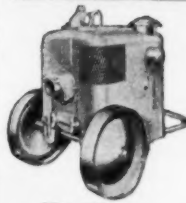
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The Water Works Digest

Artificial Recharge Of Ground Water

In many areas faced with actual or potential shortage of water, waste by continuously flowing wells or defective casings can be reduced; heavy concentrations of wells in restricted areas can be eliminated, even if necessary by transferring industries and populations elsewhere. Where the cost is warranted, salvaging of flood water and storing it in ground water reservoirs by means of artificial recharge should be investigated. This is the most widely used method of recharge. In some cases the water is stored in small lakes, from which it seeps into the ground; if it is silt-laden, the silt must be removed occasionally or the basin allowed to dry out periodically and scarified deeply. Or it may be led through ditches, from which it seeps into the aquifer. Another method is by leading the water into gravel pits.

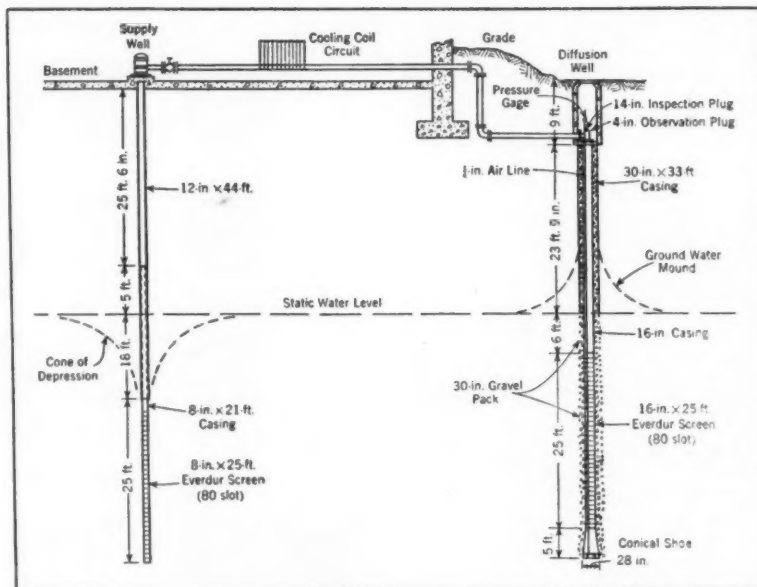
A. Nelson Sayre and V. T. Stringfield—"Artificial Recharge of Ground Water Reservoirs"; *Jour. Am. Water Works Ass'n*, November.

Returning used water to the ground, especially that used for air conditioning, by means of wells is now compulsory for large industrial users on Long Island by a New York State law. On Jan. 1, 1947, 197 air conditioning and 25 industrial plants were returning water through diffusion wells, as much as 49.4 mgd during the cooling season. These wells have been constructed to diffuse above or below the water table, or both. Apparently best results are obtained when the screens are partly above and partly below, but this is not definitely determined. Usually the well screen is a slotted casing of Everdur or other approved material. This diffusion of used water causes a rise of temperature of the ground water, and as this rise increases continuously, some change in method may be necessary.

Arthur H. Johnson—"Ground Water Recharge on Long Island"; *Jour. Am. Water Works Ass'n*, November.

Metering Fire Lines

After many years there has been developed a new fire service type of meter covered by the 1947 A.W.W.A. specifications (A.W.W.A. Jour., Feb. 1947) which measures accurately the gamut of flows to which they are subjected, and sets up no significant obstructions to full fire flows, the National Fire Protection Ass'n having approved two meters of this type as satisfying all requirements of the fire underwriters. There is therefore no reason why water utilities should not use this revenue producer. But in 1947, of 29 cities questioned only 14 approved fire line



Typical diffusion installation for ground water recharge.

meters and only one used them on all connections and 7 on some connections. At present price levels, these meters cost between \$240 for 3" to \$1,600 for 10". This cost should be paid by the customer rather than by the utility, since those that install private fire protection systems benefit financially by a 75 to 90% reduction in insurance rates.

"Actually if you grant the necessity of accounting for the water you put into your distribution system, if you grant the desirability of allocating your costs of operation equitably among your customers and if you grant the importance of maximum efficiency in your fire protection system, public or private, you are in effect favoring fire line metering. And if you do favor it, now—with a satisfactory meter available—would appear the proper time to do something about it."

Eric F. Johnson—"The Case for the Fire Line Meter"; *Jour. Am. Water Works Ass'n*, November.

Chemical and Biological Warfare

The potentialities of chemical and biological warfare agents for the destruction and devastation of life and property must not be ignored. Water resources are vulnerable to most serious damage if deliberately attacked with the new chemical and biological weapons. Because there are possibilities that these agents can be used for an attack, without warning, it is believed that the National Security Council should con-

sider making available to those responsible for the operation of water works, or to key men in the water works profession, information regarding efficient defense measures for structural protection and purification treatment of water supplies. In that way effective planning and preparations can be instituted prior to the occurrence of a national emergency.

H. H. Gerstein and Ralph E. Noble—"Possible Effects of Chemical and Biological Warfare"; *Jour. Am. Water Works Ass'n*, November.

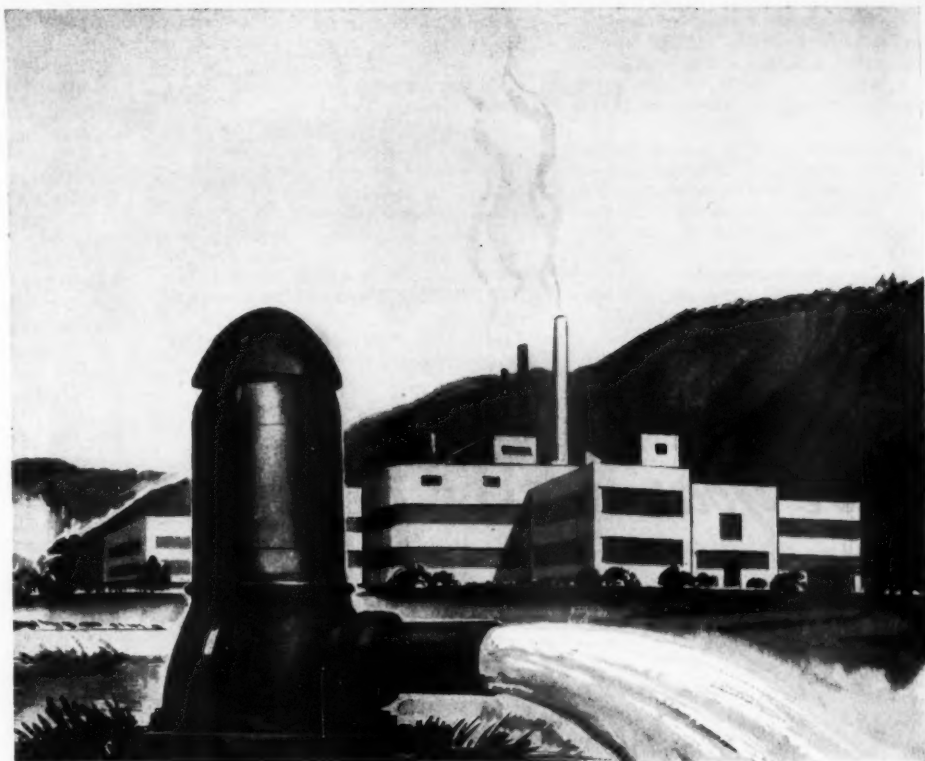
Cadmium-Coated Pipe and Fittings

The electrodeposition of cadmium has developed rapidly in the last 30 years. It gives better protection to malleable fittings than zinc. Its toxicity raises question as to its acceptability for coating water pipe and fittings. There is little evidence of actual hazard in such use, but definite findings on the subject are desirable, and a research program is proposed in the state of Michigan under university auspices.

Leo V. Garrity—"Possible Hazards Due to Cadmium-Coated Pipe and Fittings"; *Jour. Am. Water Works Ass'n*, November.

Chemical Properties Of Chlorine Dioxide

Studies have indicated some of the results of using chlorine dioxide in water treatment, but not much is known



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about the chemical reaction characteristics of the gas. The authors have investigated some of these, and report the results at length in this paper. Briefly summarized, these are as follows.

1. Chlorine dioxide can be obtained in pure solution for laboratory use by adding a weak solution of sulfuric acid to a sodium chlorite solution and then sweeping the gas into distilled water by a stream of air.

2. The gaseous solution keeps readily at refrigerator temperatures. At room temperatures it decomposes gradually to a colorless solution.

3. In pure solutions, such as in stock

solutions made up in distilled water, chlorine dioxide may be measured by the same techniques used for chlorine residuals but with some modifications, which are described.

4. Chlorine dioxide demands may be evaluated by either the acid iodide or ortho-tolidine tests but the results must be properly interpreted.

5. In general, the reactivity of chlorine dioxide with such materials as ammonia, urea, peptone and glucose is not greater and is usually less than the reactivity of chlorine with the same substances.

6. There is very little variation in chlorine dioxide demand of waters of

various degrees of organic pollution, while the chlorine demands vary widely, and are generally greater than the chlorine dioxide demand.

7. Toward either iodide or ortho-tolidine, chlorine dioxide shows two distinct oxidizing capacities, representing a two-stage breakdown to, first, the chlorite ion and, second, the reduction of the chlorite. The second step takes place only at very low pH values.

8. Free (uncombined) chlorine dioxide, like chlorine itself, may be measured by the ortho-tolidine-arsenite test, with certain provisions.

9. The chlorine dioxide demand of organic materials such as peptone follows the laws of adsorption rather than those of chemical reaction, indicating that the amount of chlorine dioxide reacting with such substances at least passes through the adsorption phase.

10. It is indicated that, for materials with which chlorine dioxide reacts directly, prechlorination will reduce the chlorine dioxide demand. When chlorine dioxide cannot react with a substance by itself, such as ammonia, chlorine may transform the material to a new form which will react with chlorine dioxide. If the substance is carried to complete reaction, as at the ammonia break-point, the chlorine dioxide demand approaches zero.

11. Evidence suggests that the bactericidal or sporicidal effectiveness of chlorine dioxide is due to its concentration, by adsorption, on the cell wall.

12. The removal of the chlorophenol taste by chlorine dioxide appears to be the result of oxidation.

R. S. Ingols and G. M. Ridenour—"Chemical Properties of Chlorine Dioxide in Water Treatment"; *Jour. Am. Water Works Ass'n*, November.

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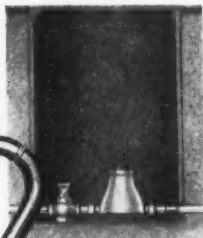
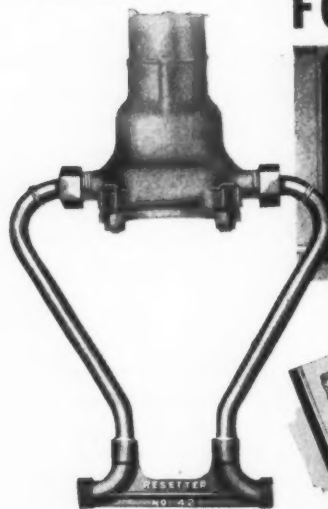


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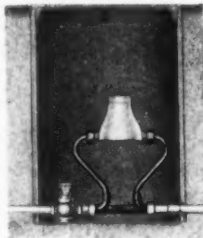
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Relining Pipe By the Eric Process

Cleaning and lining 17,000 ft. of 24" cast iron main by the Pittsburgh-Eric process was completed in March 1948. Before cleaning, the main (which had been in use 35 yr.) had a Williams & Hazen "C" of 69, and contained tubercles up to 1 1/4" high. After cleaning, the "C" was 133. Three weeks after lining, the "C" varied from 124 at 8.75 mgd to 136 at 4.36 mgd. The contract called for "C" of 125, maintained for a period of 5 yr. The cost of cleaning and lining was about \$2.34 a foot.

The coating material, called lectumen, is a processed emulsified bituminous material, which is mixed with water and put in the section of the pipe line to be treated—1,000 ft. lengths in this case. Then a cylindrical electrode is pulled through the pipe, connected to the negative pole of a generator whose positive pole is connected to the pipe. The flow of current causes bitumen to deposit on the pipe until of sufficient thickness to create a high enough resistance to stop the flow of current, thus automatically limiting the thickness of the deposit.



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Geo. S. Rawlins—"Reconditioning a 24" Cast Iron Raw Water Main"; *Water & Sewage Works*, December.

Overhauling A Sand Filter

In rebuilding the sand filters at Wheeling, W. Va., the sand is removed with a sand ejector. It is found cheaper to use new sand or anthracite than to wash the old sand. Ejectors will not handle gravel, and this is shoveled into 20-gal. garbage cans and raised through a manhole to the surface by an electric hoist. Two men on top and 2 men below removed 65 tons of gravel in 3½ days. Then the filter walls are wire brushed and the filter troughs cleaned

and painted. The filter bottom was made with cast brass strainers having stamped brass umbrella tops, and the latter were found to have disintegrated. The old bottoms were replaced with Leopold glazed tile bottoms which have proved very satisfactory. In replacing the gravel, each layer should be carefully raked level, especial care being taken with top layer of ¼" to ¾" material.

A. R. Todd—"Steps in Rebuilding a Water Filter"; *PUBLIC WORKS*, Dec.

BIBLIOGRAPHY

Am. Water Works Ass'n Journal
Service Extensions to Suburban Areas. Panel discussion by S. T. Anderson, Gen.

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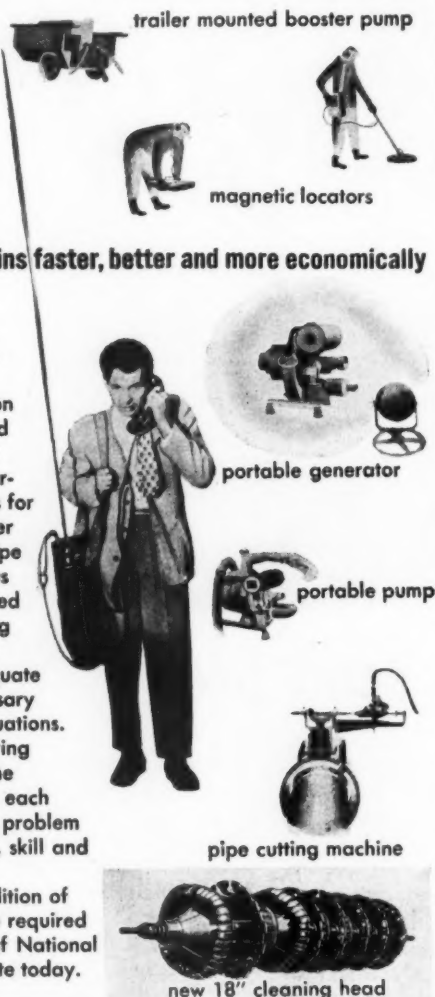
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The Outlook for Municipal Bonds. By Frederick L. Bird, Dir. of Munic. Research, Dun & Bradstreet. December, Pp. 1248-1252.

Pumping Stations for the Medium-Size City. By Francis S. Friel, Pres. Albright & Friel. December, Pp. 1253-1258.

A New Automatic Pressure-Flow Control System. By Marsden C. Smith, Chf. Engr. Public Utilities, Richmond, Va. December, Pp. 1259-1265.

Small Water Treatment Plants. By Thomas R. Lathrop, Asst. Engr. Ohio State Dept. of Health. December, Pp. 1266-1270.

Operation of Water Works Gate Valves. By Donald M. Belcher, Chapman Valve Mfg. Co. December, Pp. 1271-1276.

Removal of Hydrogen Sulfide From Well Water. By Sheppard T. Powell, Cons. Chem. Engr., and L. G. von Lossberg, Eng. Asst., Baltimore, Md. December, Pp. 1277-1290.

Characteristics and Cultivation of Sulfate-Reducing Bacteria. By Robert L. Starkey, Prof. of Microbiology, Rutgers Univ. December, Pp. 1291-1298.

Slime-Forming Organisms. By F. B. Strandskov, Bacteriologist, Wallace & Tierman Co. December, Pp. 1299-1304.

Bactericidal Properties of Free and Combined Available Chlorine. By C. T. Butterfield, head bacteriologist, U.S.P.H.S. December, Pp. 1305-1312.

Conservation and Regulation in New Jersey. By Roswell M. Roper, N. J. Dept. of Conservation, Gen. Mgr. Water Dept., East Orange, N. J. December, Pp. 1313-1314.

Engineering News-Record

New 150 MGD Intake at Cleveland, Ohio. Nov. 25, Pp. 52-56.

La Technique de l'Eau (Belgium)

Le Probleme du Comptage des Eaux Distribuees. By J. Rensburg, Engineer, Cie Intercommunale Bruxelloise des Eaux. November, Pp. 5-11.

L'Influence de la Pompe a Chaleur Sur le Rendement des Installations d'Evaporation. By W. Wittwer, Engineer. November, Pp. 17-20.

Maine Water Utilities Ass'n Journal

Method Used in Increasing Well Supply at Lubec. By J. W. Mitchell, Supt. Lubec Water & Power Co. November, Pp. 95-98.

Pennsylvania Water Works Operators Ass'n Journal

Analysis of Pipe Condition by Measurement of Carrying Capacity. By R. F. Goodhue, Eng'r, Ass'n of Fire Underwriters. Year of 1948, Pp. 86-95.

The Chester Water Plant. By K. C. Armstrong, Supt. of Filtration. Year of 1948, Pp. 96-105.

A Summation of Practices on the Extension of Water Mains into Suburban Areas. By V. F. Rigling, Eng'r, Water Utilities Service Corp. Year of 1948, Pp. 106-113.

Elements of Coagulation and Flocculation. By D. Paul Rogers, prin. chemist, and R. J. Schatz, San. Eng'r, Penn. Dept. of Health. Year of 1948, Pp. 114-123.

Public Works

Cleveland's Filtered Water Reservoir and Temporary Pumping Station. By A. G. Levy, Engr. Dept. of Public Utilities. December, Pp. 28-29, 53.

Potomac River Commission Establishes Water Quality Criteria. December, P. 30.

Steps in Rebuilding a Water Filter. By A. R. Todd, Supt. Filtration, Wheeling, W. Va. December, Pp. 35-36.

Installing Hydrant on Top of Main. December, Pp. 45-46.

The Surveyor (England)

Taste and Odor Problems at Norwich Waterworks. By S. N. Kelly, Eng'r. & Mgr., Nov. 5, Pp. 581-582.

Water and Sewage Works

Reconditioning a 24" Cast Iron Raw Water Main. (By Pittsburgh-Eric process). By Geo. S. Rawlins, of J. N. Pease & Co. December, Pp. 435-437.

Color Code Your Plant. By H. E. Lordley, Asst. Dir. Dept. of Pub. Utilities, Richmond, Va. December, Pp. 438-439.

Treatment of a Highly Colored Water.

By C. R. Harlock, Supt., and M. R. Dowlin, Operator, purification plant at McNeil Island, Wash. December, Pp. 440-442.

Water Works Engineering

Operational Practices of the Long Island Water Corporation. By Malcolm Merritt, Jr. December, Pp. 1124-1127, 1166.
Thawing Frozen Services and Mains. December, Pp. 1138, 1160.
Can the Biologist Control Algae Growth in Reservoirs? December, Pp. 1137, 1138, 1160.

Saran and Nylon at Tenafly for Sludge Filters

Tenafly, N. J., had found continuous trouble with leaks in the brass piping of its vacuum filters due to the low pH of the conditioned sludge, and in 1944 substituted Saran for the $\frac{3}{4}$ " interior piping of one filter. In June, 1945, the interior piping of the other filter was similarly replaced. Since then not a single leak has developed. The exterior $1\frac{1}{2}$ " filter is now being replaced with Saran, which costs about the same as brass.

Its fine Tark screen is cleaned with brushes, which have to be re-bristled every year. Hog bristles were used formerly, but in 1943 nylon bristles were used instead and are found to give four or five times more service than hog bristles.

Adhesion of Bitumens to Stone

Investigations conducted by the British Road Tar Assn. into the adhesion characteristics of tar binders and the properties of aggregates from the point of view of their effect on the binder, mainly with regard to adhesion in the presence of water, led to the following conclusions: (1) Deterioration in a road surfacing due to the particular properties of a tar may be the result either of displacement by water or of brittleness consequent upon weathering and age. (2) Water has a greater affinity than tar or asphalt for all normal road stones. (3) Tar offers better resistance to water action than asphalt. In the presence of water, stones with rough surface texture give better adhesion than smooth or coarsely crystalline stones. (4) Good adhesion in surface dressing is dependent upon both the quantity of tar used in relation to size of stone and the viscosity. For surface dressing in wet weather pretreatment of the aggregate is suggested, using a small proportion of a creosote solution of cetyl pyridinium bromide. (5) Incorporation of adhesion agents in the tar or use of an alkaline filler such as hydrated lime would reduce any likelihood of displacement of tar by water in tar macadam. When a tar of relatively low viscosity is used, wet

stone can be coated by the wet-aggregate lime process.

According to a French writer, M. Duriez, when cationic soaps are used as anti-stripping agents, the reactive part of the molecule is the cation and not the anion as in the case of ordinary soaps. Their special value lies in their affinity for aggregates to which ordinary binders adhere only with difficulty, especially in the presence of moisture. It is thought that a considerable range of cationic soaps may be developed for use with "acid" aggregates, the

range including materials capable of being used with asphalt as cetyl pyridinium bromide can be used with tar. A further application lies in the emulsification of asphalts or tars in a basic medium without the addition of naphthenic acids, although some difficulty might arise from the presence of an appreciable proportion of phenols. The possibility is also suggested of using cationic soaps in the manufacture of road surfacing units from siliceous powders. The present high price of these additives is offset by the very small quantities required.



WILMINGTON, DEL.

"One of America's Safest Cities"
THE MATHEWS FIREMEN SAY



SIMPLE LOGIC! For Wilmington is protected by Mathews Modernized Hydrants, which means safety plus—for two big reasons. First, the hydrant need not be out of commission long in case of an accident. All the working parts are contained in a removable barrel which can be replaced in a few minutes without excavating.

Secondly, Mathews are designed for troublefree service—as generations of use have proved. Water cannot reach the thread and rust it. A shield operating nut, capping the revolving nut, keeps out rain and dust and provides free, quick action at all times. These and other features combine to make a hydrant in which there is just about nothing to go wrong.

Send for interesting, descriptive literature and read in detail how the Mathews Modernized Hydrant can furnish the safety plus you are looking for.

OTHER MATHEWS FEATURES: Head can be turned 360° Replaceable head, nozzle outlets easily changed • Nozzle levels raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for extra strength, toughness, elasticity Operating thread only part to be lubricated • A modern barrel makes any Mathews Hydrant good as new • Low maintenance cost

MATHEWS HYDRANTS

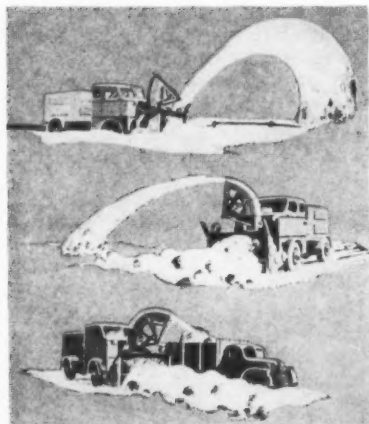
Made by R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

When writing, we will appreciate your mentioning PUBLIC WORKS

PUBLIC WORKS Equipment News



Three ways of using the Sicard Snow Master.

Lower Cost and Quicker Snow Removal

The Sicard Snow Master is a versatile and efficient machine. It can load snow into trucks at a cost of 3 or 4 cents a yard! it can deposit snow on any chosen spot; or it can blow the snow to as much as 150 ft. away, across ditches and fences, leaving a full-size passage for traffic. The discharge or loading chute can be revolved up 220°, giving great flexibility of action.

This unit is made in two sizes—the Snow Master and the Snow Master Junior. New York City has ordered 41 of the larger units, while the smaller model has been purchased by a number of municipalities in the east. Both of these have 4-wheel drive, separate engines for operating the turbines and the augers, complete hydraulic controls, and a comfortable cab fully heated.

A sound film, 16 mm, on snow removal for streets, roads and airports is available. For information on the film or for more data on snow removal, write *Sicard Industries, Inc., Watertown, N. Y.*

Use coupon on page 65; write in No. 1-1

Front End Scoop Loader for Motor Grader

With this loader attached to the Galion #402 motor grader, it is possible to windrow dirt or snow, scoop it up, and load it into trucks; also to load sand, cinders, gravel and other material from stock piles; and to do general front end loader work. Standard bucket capacity is 9 cu. ft. Maximum lifting height is 9 ft. 10 ins. Dumping clearance is 8 ft. Forward

reach is 4 ft. 6 ins. Lifting is by hydraulic power, with finger-tip control. For information about this money-saving attachment for your grader write *Galion Iron Works & Mfg. Co., Galion, Ohio.*

Use coupon on page 65; write in No. 1-2

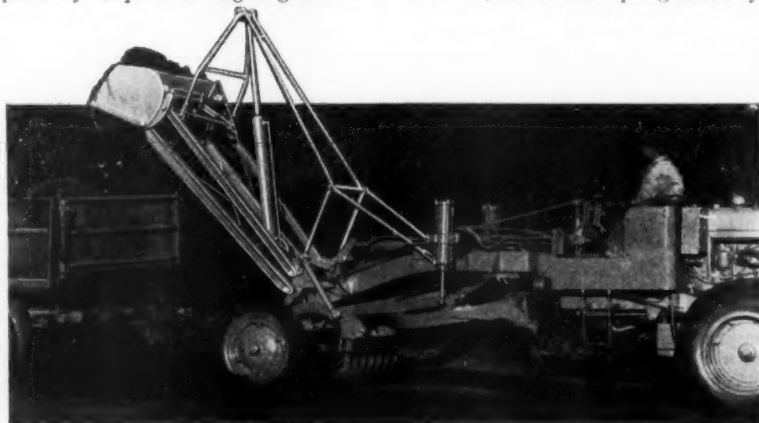
Road Sweeping Magnets

This high-intensity road sweeping magnet will remove nails, spikes, sharp pieces of steel and other tramp iron



◀ Sicard Snow Master at work.

hazards from roads, airfields, landing strips and parking lots. It can be mounted on a truck with power supplied by a portable engine-generator



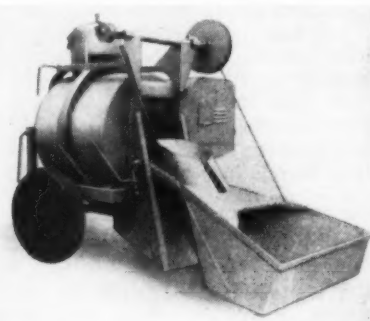
Scoop loader for attachment to Galion 402 grader.

set. Available in widths from 3 ft. to 8 ft.; can cover from 10 to 40 miles per day. *Dings Magnetic Separator Co., 4740 W. McGeogh, Milwaukee, Wis.*

Use coupon on page 65; write in No. 1-3

3½-S Mixer with Power Loader

This end discharge, non-tilting mixer has a power loader and an automatic water measuring tank. Wheelbarrows can be dumped directly into the loading skip, eliminating the necessity of shoveling. Mounting is on pneumatic-



Muller 3½-S concrete mixer.

tired disc wheels. Full data from *Muller Machinery Co., Inc., Metuchen, N. J.*

Use coupon on page 65; write in No. 1-4

Small Hydrants

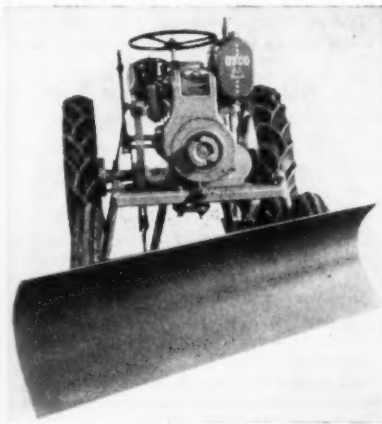
Hydrants for small water lines, generally up to 2-inch, are described in a very complete catalog. New hydrant items are the sanitary and non-freezing air-lock compression hydrant, made only in 1-inch, and air-lock spring-closed hy-

drants, 1-inch only. Anti-freeze emergency showers for chemical plants; and other equipment are shown. The small hydrants are used around sewage treatment plants, in plants and factories, etc. *Murdock Mfg. & Supply Co., Cincinnati 2, Ohio.*

Use coupon on page 65; write in No. 1-5

Wheel Tractor and Snow Plow

A reversible angle snow plow has been developed for the Osco 65 general purpose tractor, which is a small riding tractor designed to haul carts or sledges,



Osco tractor with snow plow.

for bulldozing, grass mowing, etc. Full information on tractor and snow plow from *Osco Motors Corp., Philadelphia, Pa.*

Use coupon on page 65; write in No. 1-6

Painting Over Rust or Moisture

To eliminate the necessity for having to remove all rust or to have the surface perfectly dry before painting, a combination chemical pretreatment and primer for metal has been developed. This has a vinyl base and provides a hard, paintable foundation for any type of paint. It is called Rust-O-Primer. *Wilbur & Williams Co., Greenleaf & Leon Sts., Boston 15, Mass.*

Use coupon on page 65; write in No. 1-7

Activated Stop Signs

Activating units are available for stop, school, warning and similar signs; these are simply and economically attached to such signs and give distinct warnings. For further information on this new type of warning device, write *Winko-Matic Signal Co., 750 Broadway, Lorain, Ohio.*

Use coupon on page 65; write in No. 1-8

Gasoline Pavement Breaker and Rock Drill

This is a pavement breaker and drill powered by a small gasoline engine, and requiring only a small storage battery

for operation. The Model H-6B is larger and more powerful than previous machines and can be used also as a spader or tamper, and for driving sheet or other piling. *Barco Mfg. Co., 1801 Winnemac Ave., Chicago 40, Ill.*

Use coupon on page 65; write in No. 1-9

Tunneling Made Easier

The use of light-weight corrugated tunnel lining plates and simplified tunneling procedures takes a lot of the mystery out of going underground. Advantages may include freedom from delays due to bad weather, avoiding destruction of pavements, and cheaper cost of construction. A 4-page folder gives physical properties of tunnel liner plates and considerable information on tunneling for sewers, culverts, etc. *Armco Drainage & Metal Products, Inc., Middletown, Ohio.*

Use coupon on page 65; write in No. 1-10

Saving Money on Snow Removal

This self-propelled, self-feeding, one-man operated snow loader has a capacity of 5 cu. yds. per minute. It is especially designed for small towns, cities and industrial plants. Can be used as a bucket loader with minor conversions. Ask for booklet on Model 522 snow loader, and cost figures it contains. *Barber-Greene Co., Aurora, Ill.*

Use coupon on page 65; write in No. 1-11



Economy small non-clog sewage pump.

Small-Capacity Non-Clog Sewage Pump

Primarily adapted for handling miscellaneous pulps, sewage or trash, this redesigned and improved pump has:

Cut your Asphalt Costs on those small mix jobs!

● The Foote Kinetic Asphalt Mixer with its new unusual method of mixing will give you eight to ten batches more per barrel of asphalt in less time than any other method. This saving will soon pay for the mixer.

Remember, too, that it is fully portable, can be towed behind any truck or car, handles any cold mix without additional equipment and can handle hot mixes in conjunction with kettles.

Capacity 3 cu. ft. in 30 seconds. Ask for Bulletin K-100 describing the mixer and mixing method in detail.



the **FOOTE**
Kinetic
mixer
A BLAW-KNOX PRODUCT

THE FOOTE CO., INC.

1954 State St., Nunda, New York
Subsidiary of Blaw-Knox Co.

When writing, we will appreciate your mentioning PUBLIC WORKS

Bearings grease lubricated for protection against corrosion, larger shaft and bearings, and six rings of packing. *Economy Pumps, Inc., Hamilton, Ohio.*
Use coupon on page 65; write in No. 1-12

Seven Road-Building Tools for Use with Jeeps

Seven newly designed instruments are available for use with the 4-wheel drive jeep. These are: Snow plow, terracing blade, scoop, earth mover, mower, post hole digger, and hydro-grader and terracer. The descriptions we have of these make them seem very promising. Full information on them and their uses can be obtained from the *Newgen Co., Butler, Pa.*

Use coupon on page 65; write in No. 1-13

Stainless Steel Efficient Drafting Machine

This machine is said to operate accurately on any size or make of drawing board without extra equipment or alteration of the board. It is available for boards from 24 to 132" by any length; and special machines, including left-handed equipment, can be furnished for odd-sized boards. Excellent booklet available. *Emmert Mfg. Co., Waynesboro 2, Pa.*

Use coupon on page 65; write in No. 1-14

Handy Hydraulic Crane With 360° Swing

The "360" lugger crane, which is completely hydraulically operated, is a versatile and useful tool for handling water, sewer and drainage pipe; hydrants; equipment; dumpsters; valves; and the many other items that cities and counties use in everyday maintenance and construction. Standard boom length is 20 ft., but an 8-ft. extension is avail-

able. Lifting capacity, 6,000 lbs. at 12 ft., 3500 lbs. at 20 ft. Mounted on a half-track. Full data from *Day-Smith Hydraulic Crane Corp., Bowling Green, Ohio.*

Use coupon on page 65; write in No. 1-15

Making Mineral-Free Water for Laboratories

It is said that this cartridge model demineralizer will convert tap water to equivalent-quality distilled water at a fraction of the cost of distilling. Flow capacity is 5 to 8 gals. per hour. No heat or steam is required. With the demineralizer comes an electronic conductivity controller that measures the quality of the treated water at all times. *Penfield Mfg. Co., Inc., Meriden, Conn.*

Use coupon on page 65; write in No. 1-16

Measuring Flows by the Gentile Tube

The Gentile tube consists essentially of a short length pipe equipped with two groups of pressure nozzles around the inner periphery, one group pointing upstream, the other downstream. The differential head permits measurement of the flow. The tube is normally less than one pipe diameter in length. Accuracy in measuring gases or slow moving liquids is good. Registration is said to be accurate over an 8:1 range of

flows. Full details from *Bethlehem Foundry & Machine Co., Bethlehem, Pa.*

Use coupon on page 65; write in No. 1-17

Bucket Loader for Close-In Work

Shorter base dimension permits improved maneuverability for this loader, and facilitates working in close areas, according to the manufacturer. The loader has a capacity of 2 yds. per min. in handling earth, sand and gravel. The base is 11'11" and the height 12'8", providing short turning radius and low overhead clearance. *N. P. Nelson Iron Works, Inc., Clifton, N. J.*

Use coupon on page 65; write in No. 1-18

All-Wheel Drive for Medium Trucks

All-wheel drive conversions for standard Ford trucks are now available in six models. Three are 4-wheel drive; three are 6-wheel drive. The standard Ford F-7 models are used as the basis for these conversions to provide units for heavy-duty service requiring lots of power and traction—snow removal, off the road construction and similar work. *Marmon-Herrington Co., Inc., Indianapolis, Ind.*

Use coupon on page 65; write in No. 1-19

TECHNICAL BOOKS

Limnological Methods.—By Paul S. Welch, Professor of Zoology, University of Michigan; 381 pages, 97 illustrations; the Blakiston Co.

Engineers are beginning to realize more fully the values that can be obtained by the limnologist, and this new book by Prof. Welch should be helpful to everyone with problems in water supply and stream pollution. In addition to presenting essential information on basic methods necessary for participation in this field, the author gives detailed and specific directions on procedures to be followed in making limnographical surveys of lakes and streams, and in developing fundamental information. The procedures he describes are the ones the author believes will produce satisfactory results.

The methods used in shore-line surveys of lakes, in making soundings, in stream surveys, and in map construction, along with data on determining water levels and on morphometry, are covered in the 77 pages of Part I. Temperature, the heat budget of lakes, and the effect of wind in warming lakes; turbidity determinations and the methods used; water movements and velocities; light penetration; wind velocities; and the methods used in sampling bottom materials are covered in 98 pages of Part II. In Part III is presented a limited group of those chemical methods needed for limnological work, and also those used in routine procedures in connection with the work. Biological methods are cov-

ered in Part IV, including plankton, bottom fauna and plant-inhabiting organisms. There is a great deal of useful material in the appendix. This is an excellent book, hard to read, but easy to follow when working, and with clear, explicit and detailed directions.

Introduction to Highway Engineering.—By John H. Bateman. 538 pages, 170 ill. \$5.50. John Wiley & Sons, New York.

This is the fifth edition of a well-known handbook for highway engineers. It is written by Prof. Bateman of Louisiana State University. In this new edition, the book has been brought up to date, the text matter being revised and new illustrations and problems added.

Pipe Friction Tables.—Tables show friction loss for flow of water in pipes from ½-inch to 84-inch, for the various types of pipes. For liquids other than water, tables are provided for viscous and turbulent flow for pipes ½-inch to 12-inch. There is also a very complete listing of losses in valves and fittings. Illustrative examples are worked out carefully. The price is \$1.50 and the book is published by the Hydraulic Institute, 90 West St., N. Y.

Mineral Aggregates.—A symposium on mineral aggregates is being published by the ASTM, 1916 Race St., Philadelphia, Pa. It contains 250 pages and sells for \$3 with heavy paper covers and \$3.65 with cloth binding.

PUMPING EQUIPMENT FOR SALE

Complete pumping station equipment including:

- Switchboard—23 panels.
- Manual and semi-automatic controls.
- Three vertical, electric drive, 20" centrifugal pumps, 8 mgd each, 21 ft. head.
- Three vertical, electric drive, 20" centrifugal pumps, 11 mgd each, 21 ft. head.
- Six 20" hydraulic gate valves.
- Six 20" gate valves.
- Four 150 KVA transformers, 4150 v/2300 v.
- Miscellaneous appurtenances.
- DeLaval and Westinghouse make.
- Now in operation at Trenton, New Jersey. Sewage Treatment Plant.

Write

JOSEPH E. ENGLISH

City Engineer

City Hall, Trenton, New Jersey
for details

BRIEFS OF USEFUL BOOKLETS

These are available from the manufacturer or by using the coupon on page 65.

Chlorine Dioxide.—A study by R. S. Ingols and G. M. Ridenour of the University of Michigan School of Public Health on "Some Chemical Reaction Properties of Chlorine Dioxide in Water Treatment." We believe that copies can be obtained from Mathieson Chemical Corp., 60 East 42nd St., New York.

Vacuum Filtration.—One of the finest and most educational presentations we have seen of the processes of sewage treatment and the place that vacuum filtration has in the picture. Eimco Corp., Salt Lake City 8, Utah.

Swimming Pool Equipment.—A complete and valuable 16-page booklet on this subject. How to figure filter capacity; heaters; filter design; underdrains; control of operation; recirculating pumps. Worthington Pump & Machinery Corp., Harrison, N. J.

Perforated Clay Pipe.—A 4-page folder gives all dimensions and data on improved perforated clay pipe, both standard-strength and extra-strength. These are made in sizes up to 24-inch. Sent on request to Clay Sewer Pipe Association, Inc., Huntington Bank Bldg., Columbus 15, Ohio.

Anti-Foaming and Other Compounds

Last October we mentioned the use of a compound for preventing foaming of bituminous materials. Now we have two booklets which tell more about this silicone compound and its uses. One is the "Silicone Note Book," containing much data of interest and value. The other is "New Engineering Materials." We believe either or both will be sent you on request to Dow Corning Corp., Midland, Mich.

55 Huber Maintainers for West Virginia

A total of 55 Huber maintainers have been purchased by the West Virginia State Road Commission, 30 in the spring of 1948 and another 25 recently. These sales were made through M. R. Hamill, distributor of Huber and other road equipment in West Virginia.

Palmer Surface Wash Systems

The Stuart Corp., Baltimore 1, Md., has been reappointed national distributor for Palmer Surface Wash Systems for another six years. In turn, Stuart Corp. has reappointed a number of sales agencies.

Steel Forms for Concrete.—An instruction book for engineers, contractors and builders, telling how to make columns, pilasters, walls and irregular shapes, and how to handle difficult situations. Valuable wherever poured concrete is to be used. Irvington Form and Tank Co., Irvington, New York.

Airport Lighting.—50 pages of lighting plans and wiring diagrams; lighting and distribution equipment; associated airport equipment; landing aids.

Sent on request. Westinghouse Electric Corp., PO Box 868, Pittsburgh, Pa.

Preventing Corrosion.—This 12-page folder gives "expert direction on the application of cold-applied protective coatings." Tar Products Division, Kopps Co., Inc., Pittsburgh 19, Pa.

Steel Buildings.—A 6-page folder gives a lot of data on the very useful and economical Armco "Steelox" buildings. Details of doors, windows, partitions, etc. Armco Drainage & Metal Products, Inc., Middletown, Ohio.

Industrial Water Treatment.—A new booklet describing industrial water treatment methods, with charts, diagrams and data. 20 pages. Bird-Archer Co., 400 Madison Ave., New York 17, N. Y.

How Much STRAIN Should Bell and Spigot Jointing be able to Stand?



THIS queer set-up isn't the aftermath of a nearby explosion • We rigged this 80' line ourselves—in a straight, horizontal line. Then we turned 90 lbs. water pressure into the line and later removed all but the two end supports, allowing it to sag to a drop of 7' in the center • Some small leakage developed, but it took up in time as the Tegul-MINERALEAD joints again sealed themselves. After that, the line was as tight as before • This self-sealing action is one of the advantages of this sulphur base compound.

When you lay bell & spigot main, you'd like to be sure that in case of any settling of the terrain short of a young catastrophe, the resulting leakage will right itself without



Tegul-MINERALEAD'S INGOT FORM

- Cannot be shaken down, to upset its correct composition
- Is immune to moisture. May be stored outdoors unprotected
- Is clean and easy to work in any weather
- Needs no skilled labor, caulking or deep bell holes
- Thickol content reduces initial leakage. You can back fill at once

need of digging up the line • The jointing compound that will automatically adjust after the upset pictured above, will certainly serve you well in any normal (or abnormal) circumstance.

Write for Bulletin W31—and complete information about Tegul-MINERALEAD, the ingot form bell & spigot jointing compound that saves time, trouble and labor—and delivers a better jointing job than you thought possible.

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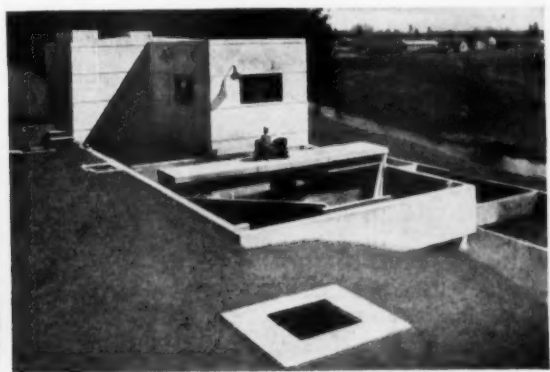
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Just Press the Button—It Does the Rest

103. Automatic Filter Operation. The Robotrol automatically back washes, re-washes and returns the filter to service. Illustrated Engineering Bulletin 1230. Infilco, Inc., 325 W. 25th Place, Chicago 16, Ill.

Pipe That Is Immune to Tuberculation and Corrosion

104. Transite Pipe. The high strength and low weight of pipe moulded under pressure from asbestos fibre and cement, together with its immunity to tuberculation and corrosion is the subject of a 32-page pamphlet. Johns-Manville, Box 290, New York 16, N. Y.

Well Water Systems Built to Last

105. Layne pumps are built for wells ranging from 4" to 36" diameter and in capacities from 50 to 16,000 gpm. Full engineering data and many installation views are given in 32 page Pump Bulletin 4-42. Layne and Bowler, Inc., Memphis, Tenn.

Pressure Pipe That Retains Capacity

106. Several bulletins describing the construction of pressure pipe, list of installations, carrying capacity tests, making service connections under pressure; and detail descriptions of several installations. Lock Joint Pipe Co., P.O. Box 269, East Orange, N. J.

Quick Way to Locate Leaks and Pipe

57. Leak Locators. Again available to waterworks superintendents, the Globe line of leak locators, dipping needles and pipe finders. Several leaflets describing the original Geophone leak locator, Little Wonder pipe phone, and the Magnetite Dipping Needle. Globe Phone Mfg. Corp., Dept. P., Reading, Mass.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.

You Can Depend On These Valves

112. Rigidly inspected gate valves for pressures up to 175 lbs. by R. D. Wood Co. Sizes 2" to 30"; for any standard type joint. R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

Handy Catalog Describes Small Hydrants, Drinking Fountains

115. This 44-page catalog describes 3/4" to 2" hydrants. Also street washers, drinking fountains and other water service devices. The Murdock Mfg. & Supply Co., 426 Plum Street, Cincinnati 2, Ohio.

Cast Iron Pipe and Fittings For Every Need

65. Cast iron pipe and fittings for water, gas, sewer and industrial service. deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Dept. PW, Burlington, N. J.

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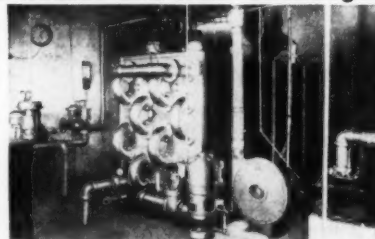
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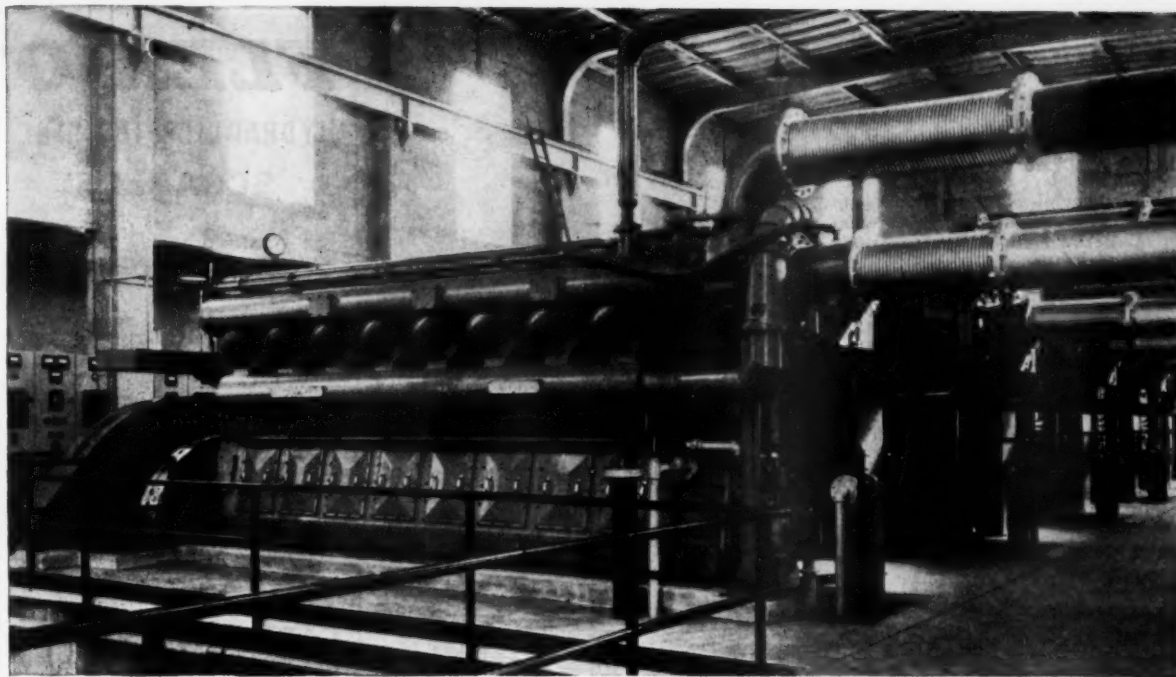
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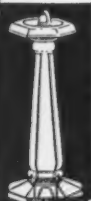
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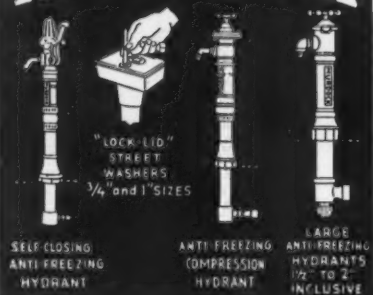
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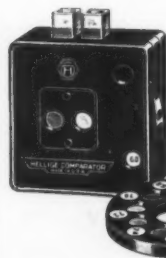
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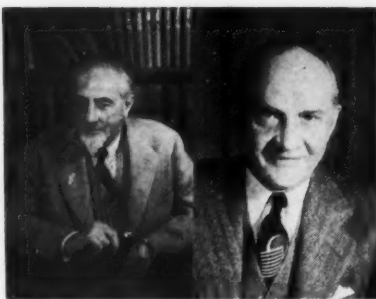
WRITE FOR BULLETIN No. 602

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HEADQUARTERS FOR COLORIMETRIC APPARATUS



Dr. Dorr, left, and Mr. Ramsey.

Dorr Co. Changes

Dr. John V. N. Dorr has become chairman of the Board of Directors of the Dorr Co., and continues as Chairman of the Board of the Dorr-Oliver Co., Ltd., London. Elmer E. Ramsey, who has been connected with the Dorr Co. for thirty-four years, and for several years has been Operating Vice-President, succeeds Dr. Dorr as President.

Personal News

Harold M. Olson, water treatment engineer, has been appointed Consulting Maintenance Engineer for the Morton Salt Co., with headquarters in the Illinois General Office, Chicago. He will be available through Morton Salt Co. for consultation on water problems.

R. S. Rankin, in charge of sanitary engineering work for Dorr Co., is spending three months in Europe to inspect water and sewage treatment installations.

Henry F. Munroe has been appointed to the sales engineering staff of Proportioners, Inc., Providence, R. I.

Douglas E. Dreier has been placed in charge of the engineering service department of Walker Process Co., Aurora, Ill.

Engineers Wanted

The U. S. Public Health Service needs qualified sanitary engineers, biologists, bacteriologists and chemists. Those accepted in the reserve corps will have a chance to make application for appointment into the regular corps with full chance for promotion to the same pay and allowances as are provided for other military services. These specialists are needed to aid in carrying out the provisions of the national water pollution control act. Applications will be received for appointment in the Public Health Service Reserve and in civil service. For positions in the commissioned corps, appointments range from 2nd Lt. to Lt. Col. Previous military service counts in pay. In civil service, positions range from P-3 (\$4479) to P-7 (\$8509) for engineers and to P-6 (\$7432) for other specialties. Write to Chief, Division of Water Pollution Control, Public Health Service, Washington, D. C., for information on appointments.

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